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Michigan's Fourth Forest Inventory: Timber Volumes and Projections of Timber Supply

John S. Spencer, Jr. and Jerold T. Hahn

North Central Forest Experiment Station
Forest Service—U. S. Department of Agriculture
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St. Paul, Minnesota 55108
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Information contained in this report includes the most commonly used Forest Inventory and Analysis (FIA) statistics. However, additional forest resource data can be provided to interested users. Persons requesting additional information that can be provided from the raw inventory data are expected to pay for the retrieval costs. These costs will vary depending on the complexity of the request, from less than $100 for a relatively simple request to $2,000 for a complete retrieval involving the services of a FIA computer programmer. If requests for data conflict with ongoing work, requests will be scheduled so as to minimize the impact on the work unit.

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Burton L. Essex
Forest Inventory and Analysis Project
North Central Forest Experiment Station
1992 Folwell Avenue
St. Paul, Minnesota 55108

Phone: (612) 642-5282

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FOREWORD

Forest Inventory and Analysis (formerly called Resources Evaluation) is a continuing endeavor as mandated by the Forest and Rangeland Renewable Resources Planning Act of 1974, the precursor of which is the McSweeney-McNary Forest Research Act of 1928. The objective of Forest Inventory and Analysis is to periodically inventory the Nation's forest land to determine its extent, condition, and volume, growth, and depletions of timber. The research branch of the USDA Forest Service is responsible for conducting these inventories and publishing summary reports for individual States. The North Central Forest Experiment Station is responsible for Forest Inventory and Analysis work done in Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, eastern South Dakota, and Wisconsin. Up-to-date resource information is essential for framing forest policies and programs.

Fieldwork for the 1980 Michigan forest inventory began in October 1977 and was completed in May 1981. This is the fourth survey of Michigan's timber resource—the three previous surveys were made in 1935 (USDA Forest Service 1936), 1955 (Findell *et al.* 1960), and 1966 (Chase *et al.* 1970).

Resource Bulletins reporting statistical highlights and detailed tables of the four Survey Units in Michigan are available from the North Central Forest Experiment Station and the Michigan Department of Natural Resources in Lansing. This publication is one of an additional series of reports that analyze the State's timber resource.

More accurate survey information was obtained during the 1980 survey than otherwise would have been feasible because of intensified field sampling. Such sampling was made possible by additional funding and personnel provided the North Central Station by the Michigan State Legislature through the Department of Natural Resources and by interested forest industries. Data from the Department's canvass of all primary wood-using plants in the State were used to help estimate the quantity of timber products harvested in Michigan.

The Michigan Department of Natural Resources and the National Forests furnished aerial photos used in the Michigan Forest Inventory.

HIGHLIGHTS

Volume

- Volume of growing stock on commercial forest land increased from 15.1 to 19.1 billion cubic feet between 1966 and 1980, a 27-percent increase.
- Softwood growing-stock volume increased 34 percent between inventories; hardwood volume gained 24 percent.
- The Northern Lower Peninsula Inventory Unit contains the largest volume with 6.8 billion cubic feet, or 36 percent of the State's growing-stock volume.
- The volume of rough and rotten trees, short-log trees, and salvable dead trees totals 2.1 billion cubic feet.
- Sugar maple, with 2.7 billion cubic feet, is the leading species in terms of growing-stock volume.
- Seventy-two percent of the growing-stock volume is in trees 12 inches in diameter and smaller.
- Nonindustrial private parties own 53 percent of the growing-stock volume.
- Average growing-stock volume per acre increased from 798 cubic feet in 1966 to 1,092 cubic feet in 1980.
- Thirty-one percent of the growing-stock volume is in stands aged 41 to 60 years.
- Sixty-nine percent of the sawtimber volume is in grade 3 saw logs. The small average diameter of sawtimber trees automatically places many into this log grade.

Stand Conditions

- Net annual growth increased from 505 million cubic feet in 1965 to 678 million cubic feet in 1979, a 34-percent gain.
- The growth rate was 3.5 percent of inventory in 1979, compared to 3.4 percent in 1965. The 1979 softwood rate was 3.8 percent and the hardwood rate was 3.4 percent.
- Average net annual growth per acre increased from 26.8 cubic feet in 1965 to 38.8 cubic feet in 1979.
- Mortality of growing-stock trees in 1979 amounted to 158 million cubic feet, 0.8 percent of inventory.
- Diseases caused the most mortality—62 million cubic feet or 39 percent of the total.

Timber Use

- Timber removals from growing stock increased from 240 million cubic feet in 1965 to 275 million cubic feet in 1979, a 15-percent gain.
- Sawtimber removals were unchanged between inventories, at 916 million board feet.
- Aspen removals amounted to 30 percent of the total, the largest share, even though aspen comprises only 14 percent of the growing-stock inventory.
- Roundwood products accounted for 81 percent of growing-stock removals, other removals for 13 percent, and logging residue for 6 percent.
- Pulpwood (47 percent) and saw logs (42 percent) account for most of the removals for roundwood products.
- Private land supplied 77 percent of the removals from growing stock, although it contained only 65 percent of the inventory.

Biomass

- Live shrub biomass (including trees less than 1 inch d.b.h.) was highest in the tamarack forest type—4,533 pounds per acre (green weight) in 1980.
- Live tree biomass (trees greater than 1 inch d.b.h.) totaled 1.0 billion green tons (an average of 60 tons per acre) in 1980.
- Highest per acre yields of live tree biomass (green weight) are in the maple-birch type (74 tons) the oak-hickory type (65 tons), the northern white-cedar type (63 tons), and the paper birch type (62 tons).

Projections

- The low removals option projection shows growing-stock inventory increasing from 19.1 billion cubic feet in 1980 to 33.2 billion in 2010, a 74 percent rise. Growth is projected to peak about 1994 but remain higher than removals throughout the period.
- The high removals option projection shows inventory increasing from 19.1 billion cubic feet in 1980 to 29.9 billion in 2010. Growth will equal removals by 2010, at which time inventory should stablize.

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MICHIGAN'S FOURTH FOREST INVENTORY: TIMBER VOLUMES AND PROJECTIONS OF TIMBER SUPPLY

John S. Spencer, Jr., *Principal Resource Analyst, and* **Jerold T. Hahn**, *Principal Mensurationist*

TIMBER VOLUME INCREASED 27 PERCENT SINCE LAST INVENTORY

Michigan's volume of growing stock on commercial forest land increased from 15.1 to 19.1 billion cubic feet between 1966 and 1980, a 27-percent increase. This volume increase coincided with a shrinking commercial forest land base. The area of commercial forest land declined from 18.9[1] to 17.5 million acres during the period between surveys, a 7.3-percent decrease. As is true throughout the Lake States, Michigan's rising timber volumes result from the forests' protracted recovery from the cutover and burned-over situation prevalent in the early 1900's. Land occupied by stumps and ashes eventually restocked to trees that successively grew to sapling, poletimber, then sawtimber size.

The volume of softwoods increased 34 percent between surveys compared with an increase of 24 percent for hardwoods as shown below:

Species	Growing-stock volume	
	1966	1980
	(Million cubic feet)	
Softwoods	4,001	5,356
Hardwoods	11,049	13,748
All species	15,050	19,104

The largest volume of growing stock is in the Northern Lower Peninsula Survey Unit (fig. 1)—6.8 billion cubic feet. This Survey Unit also had the greatest increase in volume between 1966 and 1980—38 percent (table 1).

[1] *Published 1966 area and volume statistics have been adjusted to conform to 1980 statistics because of changes in procedures and definitions. (See Making 1966 and 1980 Data compatible.)*

The four counties in the State with the largest growing-stock volumes are all in the Western Upper Peninsula—Marquette (1,264 million cubic feet), Ontonagon (857 million), Iron (786 million), and Gogebic (764 million) (fig. 2).

In addition to the 19.1 billion cubic feet of growing stock on commercial forest land in the State, there are 2.1 billion cubic feet of rough and rotten trees, short-log trees, and salvable dead trees (table 2).

MAPLES MAKE UP ONE-FOURTH OF VOLUME

Sugar maple, with 2.7 billion cubic feet, is the leading species in terms of growing-stock volume, followed closely by red maple with 2.1 billion cubic feet. If the 0.2 billion cubic feet of black and silver maple are also included, the 5.0 billion cubic feet of maple volume represents 26 percent of Michigan's total volume of growing stock. The volume of hard maples (sugar and black) increased 21 percent between 1966 and 1980, but the soft maples (red and silver) vaulted ahead by 78 percent. Soft maple volume increased faster than other major species except black walnut, black cherry, yellow-poplar, and red pine, paralleling the situation found in most of the Northeast. Red maple is fast-growing and shade tolerant and was present in the understory of many stands where conditions were right for it to grow to poletimber or sawtimber size. A challenge is to find appropriate uses and markets for this expanding red maple resource.

The volume of quaking aspen, third greatest among species in the State with 1.7 billion cubic feet, amounted to 9 percent of Michigan's growing-stock. Quaking aspen, whose volume increased 18 percent between inventories, has been used for many years in the pulp and paper industry at a reasonably constant rate. With increasing use of aspen by the sawmill

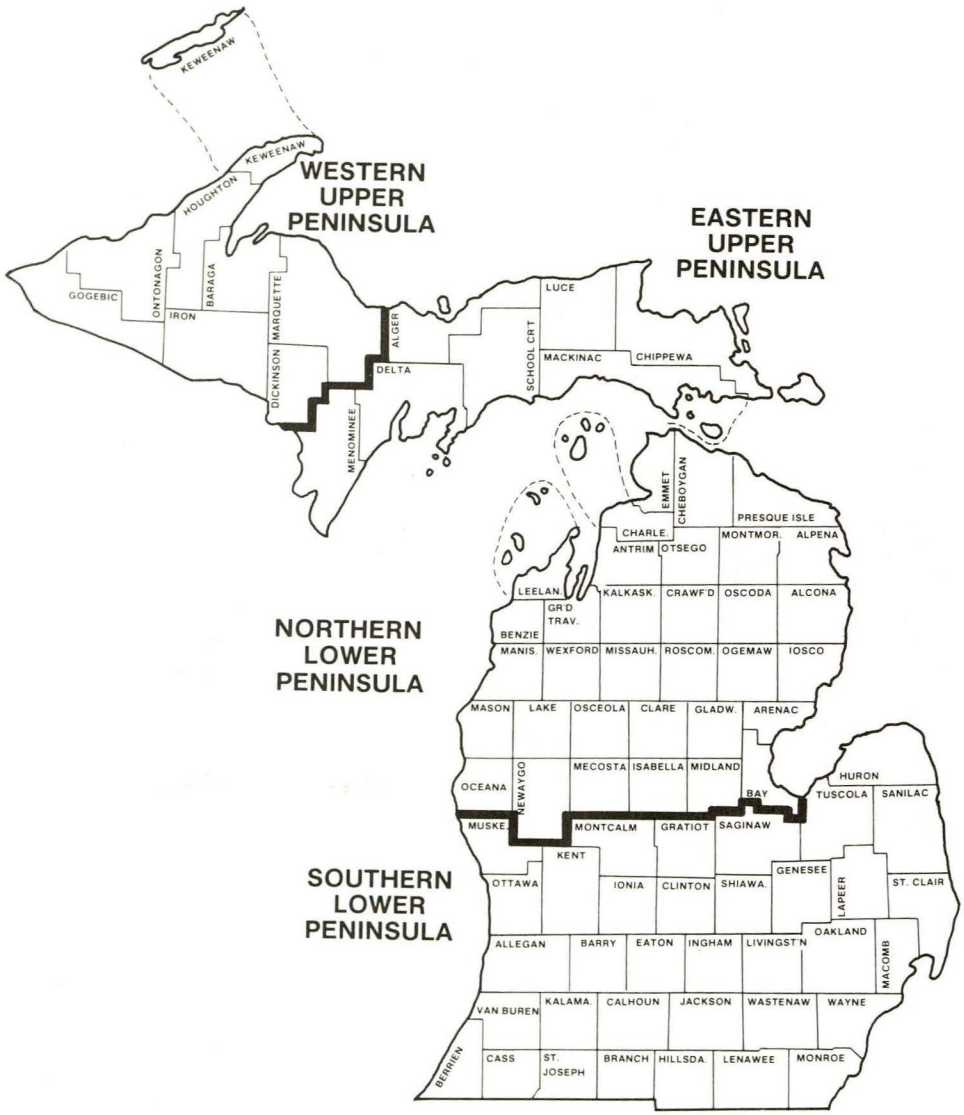

Figure 1.—*Michigan Survey Units, 1980.*

Table 1.—*Net volume of growing stock in 1966 and 1980 by Forest Survey Unit and change since 1966, Michigan*

Forest survey unit	1966 growing-stock volume	1980 growing-stock volume	Change since 1966
	Million cubic feet		*Percent*
Eastern Upper Peninsula	3,403	4,035	+19
Western Upper Peninsula	4,757	5,785	+22
Northern Lower Peninsula	4,945	6,825	+38
Southern Lower Peninsula	1,945	2,459	+26
Total	15,050	19,104	+27

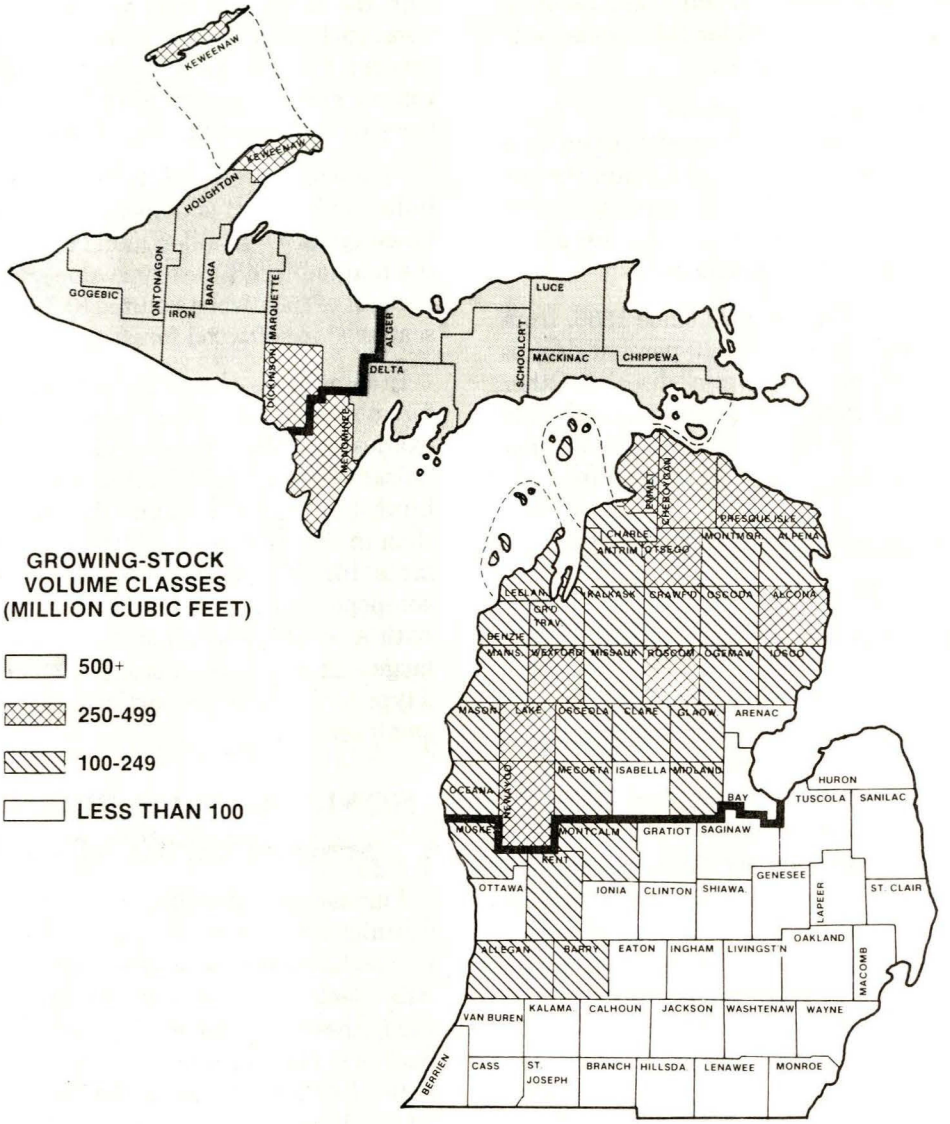

Figure 2.—*Growing-stock volume in Michigan counties by volume class, 1980.*

Table 2.—*Net volume of timber on commercial forest land by class of timber and softwoods and hardwoods, Michigan, 1980*

(In million cubic feet)

Class of timber	All species	Softwoods	Hardwoods
Growing stock			
Sawtimber	8,930	2,709	6,221
Poletimber	10,174	2,647	7,527
Total growing stock	19,104	5,356	13,748
Rough and rotten cull	1,212	219	993
Short-log cull	286	58	228
Salvable dead	628	224	404
All classes	21,230	5,857	15,373

industry and with the oriented strand board plant at Grayling utilizing aspen, demand for this species will rise.

Northern white-cedar (1.3 billion cubic feet), northern red oak (1.2 billion), bigtooth aspen (0.9 billion), paper birch (0.8 billion), and balsam fir (0.8 billion) collectively account for 26 percent of the State's growing-stock volume. The volumes of all these species increased between inventories.

Volume of elm declined the most since 1966, from 692 to 278 million cubic feet. This 60-percent drop is primarily the result of Dutch elm disease. Other species decreasing in volume are other red oaks (30 percent), beech (17 percent), yellow birch (9 percent), hemlock (6 percent), and cottonwood (4 percent).

NEARLY THREE-FOURTHS OF VOLUME IN TREES 12 INCHES IN DIAMETER AND SMALLER

Seventy-two percent of the growing-stock volume in Michigan is contained in trees 12 inches or smaller in diameter (fig. 3). More of the softwood volume (77 percent) is in these small-diameter trees than the hardwood volume (70 percent). The large number of poletimber-size softwoods in plantations, together with the large softwood volumes in typically small trees, such as jack pine, black spruce, and balsam fir, account for this. Only 30 percent of the white pine volume and 38 percent of the hemlock volume are in trees 12 inches in diameter or smaller, however.

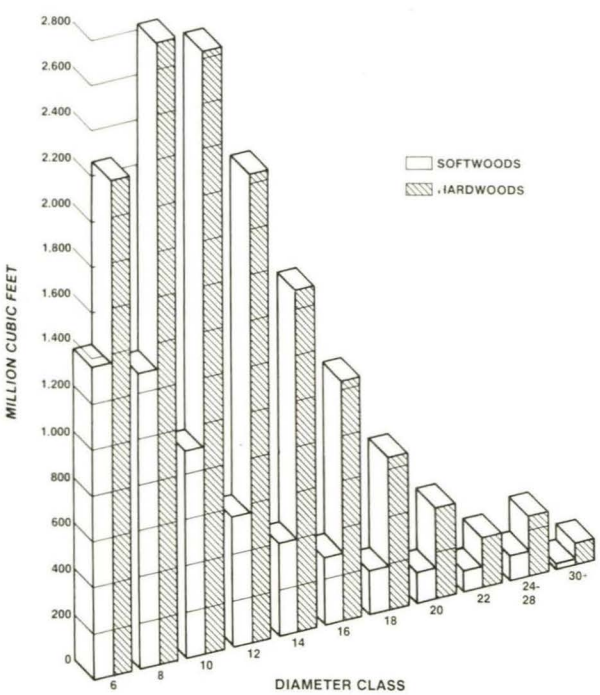

Figure 3.—*Net volume of growing stock on commerical forest land by softwoods and hardwoods and diameter class, Michigan, 1980.*

Thirty-six percent of the total softwood volume (1.9 billion cubic feet) is dispersed throughout hardwood forest types. One billion cubic feet of softwoods are in the maple-birch forest type alone. By contrast, only 5 percent of hardwood volume (0.7 billion cubic feet) is scattered in softwood forest types.

In some cases, the volume of a species is greater in a forest type other than its own primary type. For example, white spruce volume is greater in the balsam fir type (111 million cubic feet), the maple-birch type (85 million), and the aspen type (66 million) than in the white spruce type (49 million) (Appendix table 16). This is true because a species may be a component of a number of forest types, and a type with a small proportion of that species but with a large area may have more volume for the species than a type with a high proportion of the species but with a small area.

NONINDUSTRIAL PRIVATE PARTIES OWN 53 PERCENT OF VOLUME

Farmers own 3.3 billion cubic feet of growing-stock volume, 17 percent of the total; other private, nonindustrial corporations and individuals own 6.8 billion cubic feet, 36 percent of the total (fig. 4). Together, then, these owners control more than half of the State's timber volume. If forest industry's 2.4 billion cubic feet are included, the total private volume is 12.5 billion cubic feet, or two-thirds of Michigan's total.

Public agencies account for 6.6 billion cubic feet of the growing-stock volume. The State of Michigan owns 3.6 billion cubic feet and the three National Forests contain 2.8 billion. County and municipal agencies, Indian land, and miscellaneous federal agencies combined make up the remaining 0.2 billion cubic feet.

Private nonindustrial parties own a greater share of the hardwood volume than of the softwood. They own 53 percent of the total growing-stock volume but they have 58 percent of the total hardwood volume and only 38 percent of the total softwood volume. On the other hand, State land accounts for 19 percent of the total growing-stock volume—25 percent of the softwood volume and 16 percent of the hardwood volume. And the National Forests, which grow 15 percent of the State's timber volume, grow 21 percent

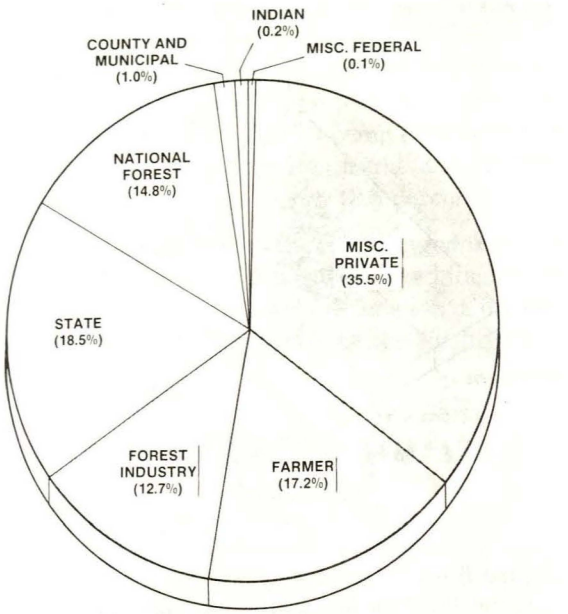

Figure 4.—*Percent of net volume of growing stock on commercial forest land by owner class, Michigan, 1980.*

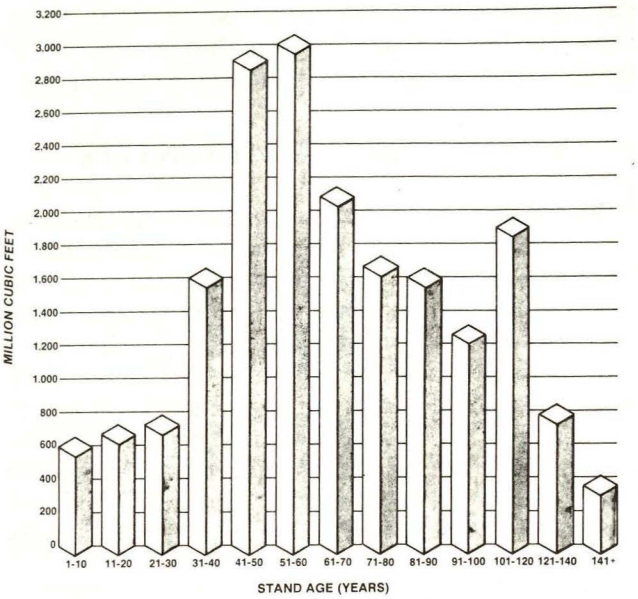

Figure 5.—*Net volume of growing stock on commercial forest land by stand-age class, Michigan, 1980.*

of the softwood volume and 12 percent of the hardwood volume.

Average volume per acre on commercial forest land is 1,092 cubic feet, compared to 798 cubic feet in 1966. Forest-industry-owned land averages 1,226 cubic feet per acre, National Forests 1,156, nonindustrial private parties 1,089, and State 992. Average volume per acre was highest in the white pine type (1,403 cubic feet), followed by the maple-birch type (1,321), northern white-cedar type (1,193), paper birch type (1,183), white spruce type (1,153), and the oak-hickory type (1,136).

LARGEST VOLUME IN STANDS 41- TO 60-YEARS-OLD

The volume of growing stock by 10-year age classes is roughly equal for stands 31- to 90-years-old, except for a surge of volume in stands aged 41-60 years (fig. 5). The enlarged volume in the latter age classes (31 percent of total growing-stock volume) corresponds to the unusually large area of stands from 41- to 60-years-old (27 percent of Michigan's commercial forest area). These stands originated between 1920 and 1939 when fire control and tree planting programs were first begun. A somewhat higher proportion of the volume in species associated with hardwood forest types is in stands more than 90 years of age (23 percent) than those in softwood types (20 percent). The long-lived hardwood species in the maple-birch and oak-hickory types contribute to this difference.

Volume in the maple-birch forest type, which predominates in Michigan with 42 percent of the growing-stock volume on 35 percent of the commercial forest area, increases in the 41- to 60-year stand-age classes. However, the volume in stands aged 61 to 120 years is reasonably evenly distributed. The type is generally long-lived, existing 120 years or more. Depending on stand conditions, either the selection, shelterwood, or clearcutting silvicultural systems can be used to regenerate maple-birch stands, although clearcutting is generally undesirable if timber is the management objective (Tubbs 1977). Individual tree selection has probably been used most in the past, which is reflected by the similarity of volumes in stands older than 60 years.

A somewhat different situation is illustrated by the distribution of volume by stand age in the shorter-lived aspen forest type, which accounts for 16 percent of the total growing-stock volume. The same bulge occurs in the 41-60 year stand-age classes; and of the 3.1 billion cubic feet in the type, 1.0 billion are in stands older than 60 years. The recommended rotation age for aspen in the Lake States depends on the site index of the stand and the desired end product. Usually, aspen on low sites (site index 50 and less) managed for fiber production is harvested at about age 35, and aspen on high sites (site index 70+) managed for sawtimber is harvested at about age 60 (Perala 1977). Generally, aspen on poor sites deteriorates earlier than high site aspen, making it prudent to harvest poor sites earlier to reduce natural loss. In Michigan, where two-thirds of the aspen volume is in

the aspen forest type, the large volume of the type beyond 60 years of age suggests that many of these stands have already experienced some degree of loss.

SAWTIMBER QUALITY IS LOW

Sixty-nine percent of Michigan's sawtimber volume is in grade 3[2] saw logs. The relatively small average tree size contributes to the preponderance of volume in this grade (as mentioned earlier, 72 percent of the total growing-stock volume is in trees 12 inches d.b.h. and smaller). Hardwoods contain a much higher percentage of volume in the higher grades (1 and 2) (30 percent) than do softwoods (7 percent) (fig. 6). Because different log grade standards and computing techniques were used in 1966 and 1980, it is not possible to compare sawtimber quality between the two surveys.

Yellow-poplar produces the highest percentage of sawtimber volume in log grades 1 and 2 (54 percent), followed by elm (47 percent), basswood (47 percent), yellow birch (41 percent), ash (39 percent), and hard maple (39 percent).

NET GROWTH RISES

The volume of net annual growth on commercial forest land increased from 505 million cubic feet in 1965 to 678 million in 1979—a 34 percent gain. Softwood growth increased faster between surveys (46 percent) than hardwood growth (30 percent).

The growth rate in 1979 is 3.5 percent of inventory, compared to a rate of 3.4 percent in 1965. The softwood growth rate in 1979 is somewhat higher (3.8 percent) than the hardwood rate (3.4 percent). Average net annual growth per acre was 45 percent higher in 1979 than it was in 1965 (fig. 7). This is a substantial gain between inventories, suggesting continued rebuilding of the State's forests.

Twenty-eight percent of the total net growth in 1979 is ingrowth—the net volume of saplings that grew to poletimber size during the year. The remainder is growth on trees already 5-inches d.b.h. and larger. The area of sapling and seedling stands has steadily declined since the mid 1950's—from 6.8 million acres in 1955 to 5.4 million acres in 1966, and, finally, to 4.4 million acres in 1980. If the decline continues, the proportion of growth attributed to ingrowth will likewise decline. This could result in

[2]*Third best of the four log grades used to estimate sawtimber quality in Michigan, as described further in the Appendix.*

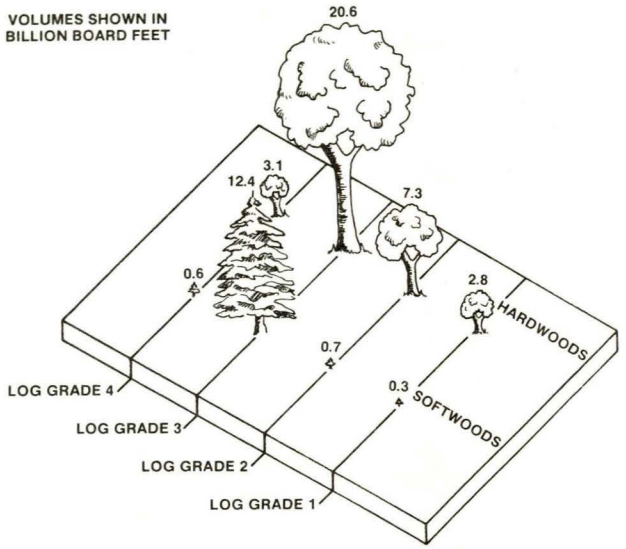

Figure 6.—*Net volume of sawtimber on commercial forest land by log grade and softwoods and hardwoods, Michigan, 1980.*

reduced net growth volumes in the future unless the level of management intensifies to the point where the added growth on trees 5-inches d.b.h. and larger offsets the shrinking ingrowth volume. The 30-year projections of inventory, growth, and removals discussed later in this report assume a level of forest management unchanged from recent trends. Both the low and the high removals option projections indicate a peak in volume of net annual growth around 1994, followed by a decline.

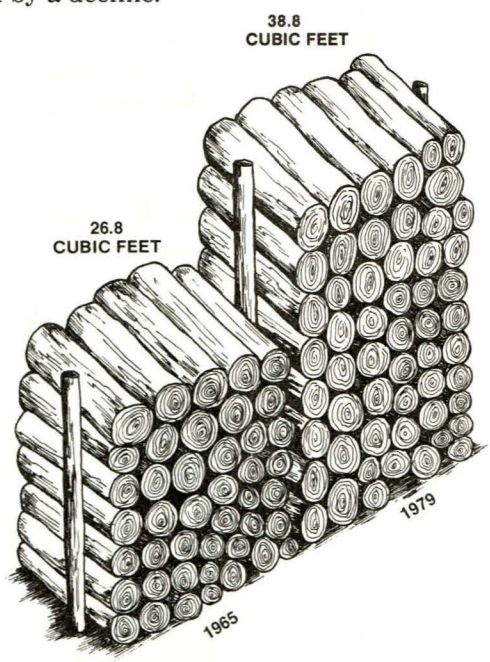

Figure 7.—*Average net annual growth per acre of growing stock on commercial forest land, Michigan, 1965 and 1979.*

Although the Lower Peninsula supports 49 percent of the State's growing-stock inventory, it accounts for 52 percent of the net growth volume. Growth rates are highest in the Northern Lower Peninsula (3.9 percent), followed by the Southern Lower Peninsula (3.6 percent), the Western Upper Peninsula (3.4 percent), and the Eastern Upper Peninsula (3.3 percent).

Growth rates for individual species ranged from 6.3 percent for red pine and 5.8 percent for white spruce and ash to a negative 4.4 percent for elm. Elm lost ground because mortality from Dutch elm disease exceeded growth.

POTENTIAL GROWTH ESTIMATED

We cannot accurately measure the potential net growth (or productive potential) of the State's commercial forest at present. However, we made a crude estimate using site class information. Site class values indicate the annual volume of growth per acre of fully stocked natural stands at culmination of mean annual increment. By multiplying the area in each site class by the midpoint of the growth range in that class, we estimated the potential growth in the State (table 3). This method yields inflated results because most stands in Michigan are not fully stocked and are not natural (unmanaged or uncut). Also, it does not take into account the present distribution of age classes or the obvious differences in growth among them. Spurr and Vaux (1976) discounted an estimate of potential growth for the Nation by 10 percent to arrive at what they considered a realistic figure. A recent study of the aspen type in Wisconsin suggests that potential growth is 52 percent higher than current growth (Lundgren and Hahn 1978).

Using the above method, the potential net annual growth for Michigan is 1.1 billion cubic feet or 64 cubic feet per acre. Discounting this potential growth by 10 percent results in 1.0 billion cubic feet or 57 cubic feet per acre, which is a better estimate but one of unknown reliability.

Potential growth could be pushed even higher by widespread intensive forest management including thinning, planting genetically superior trees, and fertilizing.

DISEASE CAUSES LARGEST MORTALITY VOLUME

Mortality of growing-stock trees in 1979 amounted to 158 million cubic feet, 0.8 percent of inventory. The mortality rate for softwoods and hardwoods is virtually unchanged—0.8 percent and 0.9 percent, respectively. Highest rates are for elm (9.5 percent), tamarack (4.2 percent), balsam fir (3.1 percent), balsam poplar (2.1 percent), quaking aspen (1.9 percent), and bigtooth aspen (1.3 percent).

Disease destroyed more growing-stock volume than any other identifiable agent—62 million cubic feet or 39 percent of the total mortality volume. Diseases of elm, principally Dutch elm disease, accounted for 21 million cubic feet; and diseases of aspens, chiefly hypoxylon canker, accounted for 21 million cubic feet. Weather (19 million cubic feet) and insects (5 million cubic feet) follow disease as a cause of mortality. Volume losses from the spruce budworm, responsible for most of the insect-caused mortality shown in this report for 1979, are much less than those just several years later. Although defoliation and some mortality from the current spruce budworm outbreak had occurred while fieldwork for this survey was underway, most of it took place after 1980 when fieldwork was finished in the Upper Peninsula, where most of the State's balsam fir grows.

Table 3.—*Estimation of potential net annual growth on commercial forest land, Michigan, 1979*

Site class (cu ft/acre/year)	Area of commercial forest land	Potential[1] net growth per acre	Total potential net growth
	Thousand acres	*Cu ft/acre/yr*	*Thousand cu ft/yr*
224-165	4.9	194.5	953.1
164-120	461.3	142.0	65,504.6
119-85	3,493.6	102.0	356,347.2
84-50	6,879.2	67.0	460,906.4
49-20	6,650.5	34.5	229,442.3
Total	17,489.5		1,113,153.6

[1] Midpoint of site class interval.

The proportion of mortality caused by insects and diseases differed substantially for softwoods and hardwoods (fig. 8).

Annual mortality of sawtimber in 1979 was 340 million board feet, 0.7 percent of inventory.

TIMBER REMOVALS GAIN

Timber removals from growing stock in 1979 were 15 percent higher than in 1965. Softwood removals declined 4 percent, but hardwood removals increased 21 percent between surveys:

Species	Timber removals from growing stock	
	1965	1979
	(Million cubic feet)	
Softwoods	59.0	56.4
Hardwoods	180.6	218.2
All species	239.6	274.6

Total sawtimber removals were practically unchanged between inventories. However, softwood removals dipped 14 percent, and hardwood removals gained 4 percent from 1965 to 1979:

Species	Timber removals from sawtimber	
	1965	1979
	(Million board feet)	
Softwoods	192.1	165.2
Hardwoods	723.7	750.3
All species	915.8	915.5

The aspens accounted for the largest share of growing-stock removals in 1979 with 83.2 million cubic feet. This amounts to 30 percent of total removals, even though the aspens comprise only 14 percent of total inventory. Aspen removals in 1965 were 72.9 million cubic feet. Removals of hard maple were second largest in 1979 with 32.3 million cubic feet, 18 percent higher than in 1965. Soft maple removals spurted from 12.6 to 24.0 million cubic feet between inventories. This amounts to a 91 percent gain, largest of any species. Select red oak (20.6 million cubic feet), jack pine (16.2 million cubic feet), and select white oaks (9.0 million cubic feet) also had large removals volumes.

Eighty-one percent of the removals volume (223.0 million cubic feet) was harvested for roundwood products, such as pulpwood, saw logs, and fuelwood. Other removals, trees removed but not used for products or trees left standing but "removed" from the commercial forest classification by land use change, amounted to 13 percent of the volume of removals (34.8 million cubic feet). Logging residue, unused trees killed by logging or the unused portion of cut

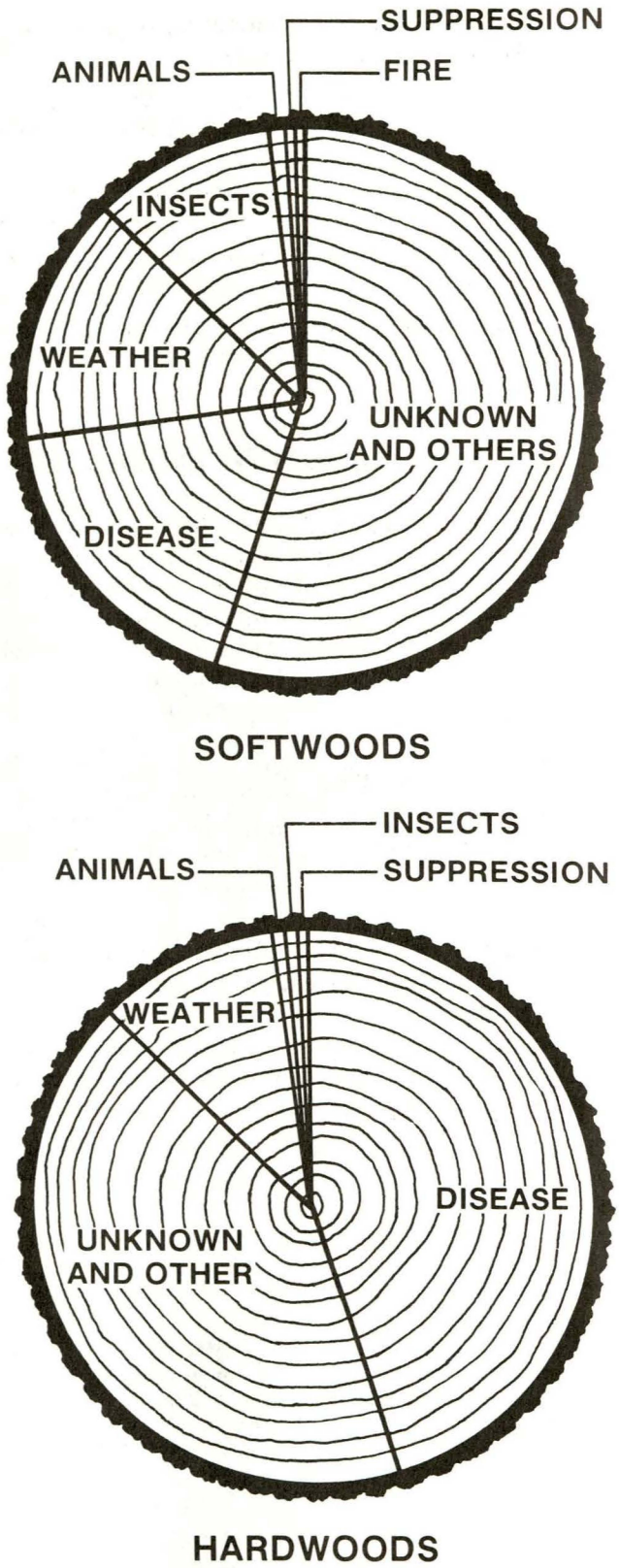

Figure 8.—*Annual mortality of growing stock on commercial forest land by cause of death and softwoods and hardwoods, Michigan, 1979.*

trees, accounted for the remaining 6 percent of removals (16.8 million cubic feet).

Pulpwood (104.7 million cubic feet) and saw logs (93.8 million cubic feet) are the roundwood products from growing stock most in demand. Removals for fuelwood amounted to 8.3 million cubic feet in 1979, up 68 percent from the 5.0 million cubic feet in 1965. Removals for fuelwood are expected to climb as long as home-heating costs remain high.

The bulk of removals from sawtimber-size trees for roundwood products was, of course, saw logs, with 513 million board feet or two-thirds of the total.

The Northern Lower Peninsula Unit produced 38 percent of the growing-stock removals, although it contains 36 percent of the growing-stock inventory. The Western Upper Peninsula Unit accounted for 28 percent of removals (30 percent of inventory), the Eastern Upper Peninsula Unit contributed 20 percent of removals (21 percent of inventory), and the Southern Lower Peninsula Unit made up 14 percent of removals (13 percent of inventory).

Private land supplied 77 percent of the removals from growing stock but contained only 65 percent of the inventory. The 212 million cubic feet of removals from private land converts to a removals rate of 1.7 percent, compared to a rate from public land of 0.9 percent.

REMOVALS ARE 40 PERCENT OF GROWTH

A common way to evaluate the level of removals is by comparing removals with growth. In Michigan, the 275 million cubic feet of removals in 1979 were far less than the 678 million cubic feet of net growth. However, in States like Michigan where many stands are young and much of the growth volume is contributed by trees too small to be an important part of the removals volume, this kind of comparison is simplistic and potentially misleading. Another method that better represents the likely future scenario is to compare estimates of future removals with the predicted yields resulting from potential forest management activities. Estimates of such predicted yields for Michigan from 1980 to 2010 were published by Smith and Jakes (1983). The Stand and Tree Evaluation and Modeling System (STEMS), a set of computer programs for projecting the growth of forest stands, was used to project Michigan's commercial timber supply for the next three decades (Belcher *et al.* 1982). STEMS was programmed to select four treatment opportunities: harvest, thinning, timber stand improvement, and stand conversion or restocking. The management criteria for selecting treatments were developed in conjunction with foresters from the Michigan Department of Natural Resources. STEMS then produced tables showing the areas qualifying for each treatment and the volumes to be removed during those treatment operations. These volumes were compared to estimates of future removals in order to judge if timber shortages may be a possibility in the years ahead. Two estimates of removals were made—a high level and a low level.

These comparisons suggest that yields resulting from all STEMS treatments (supply) should exceed the high and low estimates of removals (demand) for both softwoods and hardwoods throughout the 30-year projection period (table 4). This implies a level of management much intensified from the current level. However, yields from STEMS harvest treatment

Table 4.—*Comparison of estimated average annual yield from treatment of commercial forest land to estimated average annual removals (high and low levels) from growing stock, for softwoods and hardwoods, Michigan, 1981 to 2010*

(In million cubic feet)

Species group and decade	Estimated average annual yield		Estimated average annual removals from growing stock	
	From STEMS harvest treatment	From all STEMS treatments	High level	Low level
Softwoods				
1981-1990	140.7	164.9	69.7	54.9
1991-2000	170.5	199.8	115.9	71.2
2001-2010	202.0	236.1	171.1	97.9
Hardwoods				
1981-1990	297.1	405.6	244.3	214.4
1991-2000	357.8	467.2	316.9	260.3
2001-2010	374.4	504.2	400.4	319.8

alone may not be adequate to meet the high estimate of demand for certain hardwood species by the middle of the third decade.

We compared 1979 removals from growing stock with STEMS estimated yields from treatments during the decade 1981-1990 by individual species. This comparison suggests that removals for some species already exceed the average for the decade ahead and that the opportunity exists to increase removals for other species. Removals in 1979 in some survey units for jack pine and aspen were greater than average annual yields during 1981-1990, but removals of paper birch are much lower than STEMS yields and, perhaps, could be doubled.

The STEMS yields are based on the following assumptions: (1) all commercial forest land is available for treatment, (2) markets exist for all species and products, and (3) no economic, social, or political constraints are placed on performing the treatments. Because these assumptions represent ideal rather than existing conditions, the yields generated by STEMS should be discounted accordingly (table 4).

FOREST BIOMASS ESTIMATED

Interest in the total volume of trees (including limbs, leaves, and bark) and shrubs is gaining as wood receives increasing attention as a source of energy, as technological change permits wood fiber to be used in innovative ways, and as timber harvesting costs continue to rise. In recognition of this interest an estimate of the aboveground green weight of live trees and shrubs in Michigan was made as part of the inventory.

The total biomass of all live trees at least one inch in d.b.h. on commercial forest land is 1.0 billion green tons (an average of 60 tons per acre) in 1980. The largest weight of biomass is in the maple-birch forest type with 450 million tons (74 tons per acre), the aspen type with 166 million tons (49 tons per acre), the oak-hickory type with 116 million tons (65 tons per acre), and the northern white-cedar type with 74 million tons (63 tons per acre).

Fifty-one percent of the total live tree biomass is in the boles of growing-stock trees and 24 percent of the total is in the tops and limbs of growing-stock trees as shown in the following tabulation:

Biomass component	Weight (Million green tons)
Growing-stock trees	
Boles	530.9
Tops and limbs	247.6
Cull trees	
Boles	44.7
Tops and limbs	29.6
1- to 5-inch trees	193.7
Total	1,046.5

Shrub biomass is greatest in the tamarack forest type where it averages 4,533 pounds per acre, followed by the black spruce type (3,250 pounds per acre), the balsam fir type (2,730 pounds per acre), and the elm-ash-soft maple type (2,244 pounds per acre).

Among the tall shrubs, which include live trees less than 1-inch in d.b.h., the species with the greatest average biomass is sugar maple with 209 pounds per acre[3]. Speckled alder was next with 197 pounds per acre, followed by balsam fir with 103 pounds per acre and red maple with 96 pounds per acre.

Bilberry-blueberry, among the low shrub species, had the greatest average biomass, 53 pounds per acre. Raspberry-blackberry followed with 28 pounds per acre, then leatherleaf (18 pounds per acre), and labrador tea (11 pounds per acre). Many shrub species, both tall and low, are important as wildlife food and cover.

PROJECTIONS OF NATIONAL TIMBER SUPPLY

The most recent projection of national demand for roundwood shows consumption increasing from 13.3 billion cubic feet in 1976 to 25.2 billion in 2010, an 89-percent jump (USDA Forest Service 1980). Softwood demand is projected to grow from 10.3 to 17.7 billion cubic feet during the same period—a 72-percent gain—but hardwood demand is projected to jump from 3.0 to 7.5 billion cubic feet—a 150-percent increase. The faster rate of growth for hardwoods reflects a projected rise in demand for hardwood pulp products, hardwood lumber for pallets and railroad ties, and hardwood plywood and veneer for furniture. This projection, made at a medium level of population and economic growth, assumes that the price trends

[3] *A weighted average based on the number of plots sampled in each forest type and the biomass of each species in the type, including types in which the shrub species was not found.*

in the base period used in making the projection (roughly from the late 1950's through the mid 1970's) continue through the projection period.[4] When the excess of roundwood imports (4.5 billion cubic feet) over exports (1.5 billion) is subtracted from the projected demand in 2010, the result is the demand on United States forests—22.2 billion cubic feet.

National supplies (timber available for harvest) of roundwood are projected to increase from 12.1 to 18.7 billion cubic feet between 1976 and 2010.[5] Projected demand on United States forests in 2010 exceeds supply by 3.5 billion cubic feet. The short-fall for softwoods (3.3 billion) is much larger than that for hardwoods (0.2 billion).

MICHIGAN'S TIMBER PROJECTIONS

Michigan's timber resource will play a significant role in the Nation's demand-supply outlook. A look at what is likely to happen to the State's future timber resource under several levels of removals can help put Michigan in perspective with the Nation.

Two 30-year projections of the State's timber situation were made using the Timber Resource Analysis System (TRAS) program (USDA Forest Service 1970). One projection assumes a continuation of recent levels of timber removals (low removals option), and the other assumes a higher level of removals (high removals option). Separate projections were made for softwoods and hardwoods. TRAS uses a stand-projection technique involving input of number of trees, growth rates, mortality rates, and removal rates, all by 2-inch diameter classes, along with assumed total removals by year and assumed ingrowth into the 2-inch diameter class.

Assumptions common to both options are: (1) the total area of commercial forest land will decline from 17.5 million acres in 1980 to 17.2 million acres in 2010; (2) radial growth will decline in relation to the increase of basal area per acre of trees; (3) the intensity of forest management will continue at the rate indicated by recent trends; and (4) the volume of "other" removals will drop during the period as more of these trees are utilized for products.

[4] *Another projection was made assuming that prices will rise enough to maintain an equilibrium between projected demand and supply.*

[5] *Projection shows the volume of timber available for harvest from domestic forests if recent trends in the forces determining supply, such as commercial timberland area, management, and prices, continue through the projection period.*

LOW REMOVALS OPTION PROJECTION

The low option assumes that softwood timber removals will decline to about 54 million cubic feet in 1985 and then increase to 110 million cubic feet per year by 2010. It assumes that hardwood removals will decline to 210 million cubic feet in 1985; and then increase to 347 million cubic feet per year by 2010 (table 5). Growth is projected to exceed removals, to peak about 1993, and then to turn down. Therefore, inventory is projected to increase at an average annual rate of 2.45 percent or 469 million cubic feet (fig. 9).

This projection shows removals increasing from 275 million cubic feet in 1979 to 456 million in 2010, a 66 percent gain. Removals for the major roundwood products—pulpwood, saw logs, and fuelwood—are all assumed to rise during the projection period but more of these products are assumed to be recovered from "other" removals.

Growth is projected to increase from 678 million cubic feet in 1979 to 852 million in 1990, then to decline to 674 million in 2010. At the beginning of the projection period, the surplus of growth over removals is 403 million cubic feet. By 1990 the surplus is projected to grow to 568 million cubic feet, but by 2010 it is projected to shrink to 218 million.

The 1980 inventory of 19.1 billion cubic feet is projected to rise to 33.2 billion in 2010, a 74 percent gain. The rise of the inventory curve remains fairly constant over the entire projection period.

HIGH REMOVALS OPTION PROJECTION

Timber removals under this option are assumed to increase at different rates for each 5-year period but

Table 5.—*Assumed average annual change of timber removals used in projections of timber resource in Michigan, 1980-2010*

Period	Low removals option		High removals option	
	Soft-woods	Hard-woods	Soft-woods	Hard-woods
	Percent annual change			
1980-1984	-1.2	-1.0	2.5	1.3
1985-1989	1.0	1.2	4.6	2.6
1990-1994	3.6	2.7	6.2	2.9
1995-1999	4.0	2.3	4.8	2.5
2000-2004	3.1	2.0	3.6	2.3
2005-2010	2.5	1.8	3.2	2.2

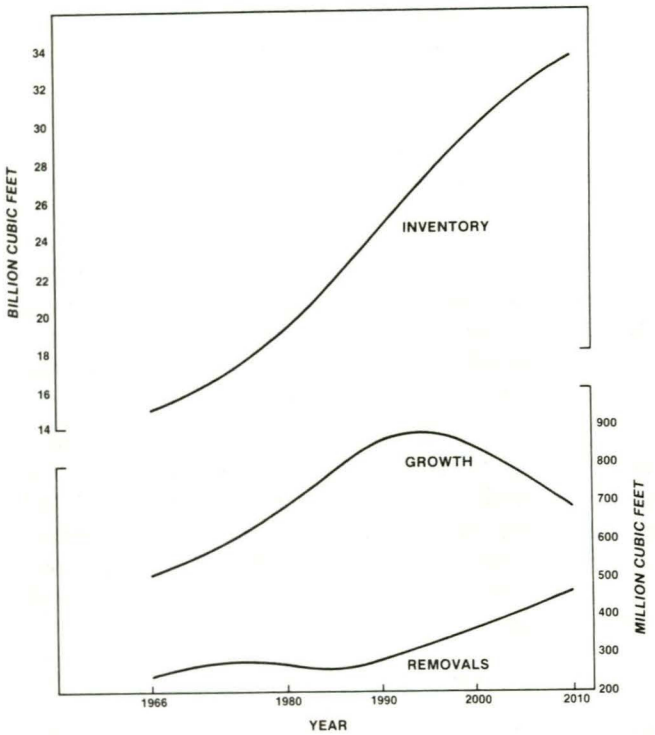

Figure 9.—*Removals, net growth, and inventory of growing stock in Michigan, 1966 and 1980, and low removals option projection for 1981-2010.*

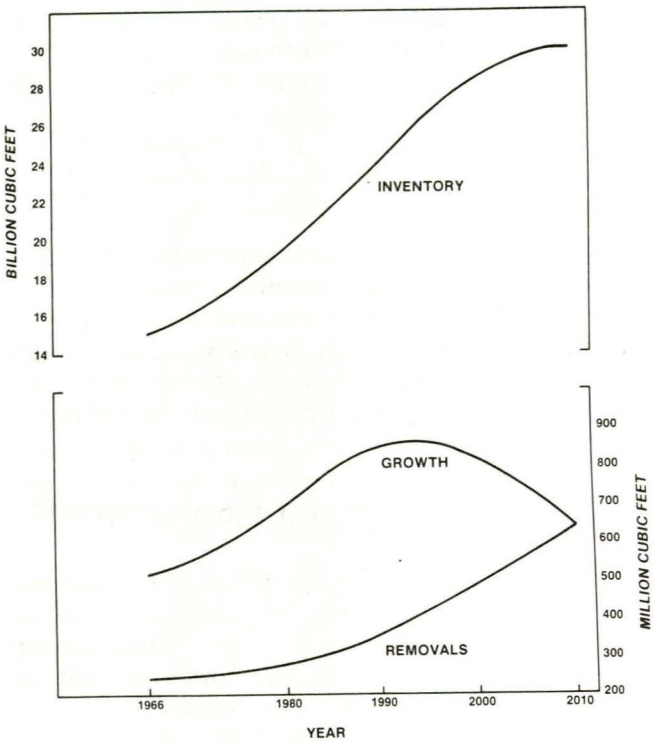

Figure 10.—*Removals, net growth, and inventory of growing stock in Michigan, 1966 and 1980, and high removals option projection for 1981-2010.*

to increase at an average annual rate of 4.4 percent (table 5). Removals will converge with growth about 2010. Inventory is projected to increase more slowly as growth approaches removals and then to go flat when the two are equal (fig. 10).

Under the high removals option, removals jump from 275 to 638 million cubic feet between 1979 and 2010, a 132 percent gain. Softwood removals are projected to increase from 56 to 197 million cubic feet. This option assumes larger markets for roundwood products than the low removals option does.

The 1979 growth of 678 million cubic feet is projected to rise to 857 million by 1994, then to sag to 639 million by 2010. The excess of growth over removals of 403 million cubic feet in 1979 is projected to enlarge to 494 million in 1988, then to do an about-face and end with removals approximately equal to growth at 638 million cubic feet by 2010.

Inventory rises quickly from 19.1 to 28.0 billion cubic feet between 1980 and 2000. Then, in response to the narrowing difference between removals and growth, the rate of increase slows so that by 2010 inventory is about 29.9 billion cubic feet.

THE OUTLOOK

The low and high removals options represent the forest situation only if the assumptions upon which they are based are realized. The projections are not intended to convey what is desirable from silvicultural, economic, or social viewpoints; they are simply indicators of what is likely to happen if forests are managed much as they have been for the last 15 years and if harvesting occurs at a "high" or "low" level. Projections for the first decade are the most meaningful because fast-changing market and economic conditions can quickly nullify the assumptions made for the projections for the last two decades.

Inventory, then, is likely to continue accumulating at a rate similar to that of recent trends. A more intensive level of timber management than that assumed could lead to increased timber growth and larger-than-projected inventories. Timber stand treatment opportunities in the State from 1981 to 2010 are discussed in "Michigan's Predicted Timber Yields 1981-2010" (Jakes and Smith 1983). Timber supplies might also be extended through more complete utilization of residues, tree tops, and limbs, the volumes of which are not included in growing-stock inventories. Inventories would also be larger than pro-

jected if the actual area of commercial forest land converted to other uses is less than assumed or if much of the land converted is of low site quality.

The maple-birch type occupied 6.1 million acres (35 percent) of Michigan's commercial forest land in 1980, an increase of almost 900,000 acres since 1966. This increase, which is expected to continue but at a slower rate, reflects the increasing maturity of the State's forests and a trend toward climax types. The increase in the maple-birch type contrasts with the loss of 744,000 acres in the aspen type, a trend that is also expected to continue, at least for the short run. As more aspen stands are intensively managed, the decline in aspen type may slow or reverse. These trends could suggest potential problems for industries using the aspen resource but may represent opportunities for expansion in those industries able to use maple, basswood, and associated species. It seems likely that the volume of red and white pines, species traditionally preferred for lumber in the State, will increase in the future. The areas of these forest types are expected to increase slighty due to the amount of past and continuing red pine plantings. However, large diameter softwood trees will be less plentiful. Future softwood yields will also increase as a result of the ongoing tree improvement efforts to provide genetically superior planting stock.

Nonindustrial private forest landowners control 53 percent of the commercial forest land and 53 percent of the growing-stock volume. Policies that seek to bring practical, technical information and assistance on forest management to these owners will help to achieve a more favorable future timber outlook for the State. And policies that make timber growing more profitable for these owners will have the same effect. Expanded markets for timber products and financial incentives, such as tax incentives for forest landowners and cost-share programs for tree planting and timber stand improvement, are some ways to make enlightened timber management more attractive to these owners.

However, more immediate gains from improved forest management are more likely to come from public and forest industry land. Owners of this land have greater access to technology and capital and a stronger commitment to use them to supply the market system.

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APPENDIX

ACCURACY OF SURVEY

Forest Inventory and Analysis information is based on a sampling procedure designed to provide reliable statistics at the State and Survey Unit level. Consequently, the reported figures are estimates only. A measure of reliability of these figures is given by sampling errors. These sampling errors mean the chances are two out of three that the true inventory value is within the limits indicated.

For example, the estimated growing-stock volume in Michigan in 1980, 19,103.8 million cubic feet, has a sampling error of ±0.70 percent (±133.7 million cubic feet). Therefore, the growing-stock volume from a 100-percent inventory would have a two in three chance of falling between 18,970.1 and 19,237.5 million cubic feet.

The following tabulation shows the sampling errors for the 1980 Michigan inventory:

Item	State totals	Sampling error
Growing stock	(Million cubic feet)	(Percent)
Volume	19,103.8	0.70
Growth	677.8	1.04
Removals	274.6	7.17
Sawtimber	(Million board feet)	
Volume	47,669.1	1.08
Growth	2,384.4	1.74
Removals	915.5	8.31
Commercial forest area	(Thousand acres) 17,489.5	0.33

As survey data are broken down into sections smaller than State or Survey Unit totals, the sampling error increases. For example, the sampling error for growing-stock volume in a particular Unit or county is higher than that for total growing-stock volume in the State (table 62 shows the sampling errors for estimates smaller than State totals).

SURVEY PROCEDURES

The major steps in the survey of Michigan were as follows:

1. A total of 176,976 1-acre points were systematically distributed across aerial photos of the entire State, except the National Forests. In order to make a preliminary estimate of forest area, these points were classified into land classes (table 6). Next, a total of 83,103 of these points were stereoclassified by forest type, stand-size class, and density. Finally, 13,991 points were examined on the ground to correct the preliminary area estimate for errors in classification and for actual changes in land use since the photos were taken.

At each forest ground plot location, variable-radius plots (basal area factor 37.5) were established at 10 points uniformly placed over the sample acre. Tree

Table 6.—*Number of photo points classified and stereoclassified, and number of ground plots visited, Michigan, 1980*

(In number)

Land class	Photo points classified	Photo points stereoclassified	Ground plots visited
Forest land	82,170	82,170	7,706
Unproductive forest land	114	114	16
Nonforest land			
with trees	3,029	182	182
without trees	86,327	0	5,626
water	4,699	0	379
Questionable	637	637	82
Total	176,976	83,103	13,991

measurements made at these locations and at 775 plots established in 1966 and remeasured in 1980 were the basis for estimates of timber volume, growth, mortality, number of trees, and other forest classifications on non-National Forest land. Estimates for National Forest land were based on 588 plots established between 1976 and 1980 on the Huron-Manistee, Hiawatha, and Ottawa National Forests.

2. Growth and mortality on all commercial forest land were estimated using the Stand and Tree Evaluation and Modeling System (STEMS)[6] after the System was adjusted with factors derived from the remeasurement of plots established in 1965. STEMS is an individual tree-growth projection system that uses the following stand and tree characteristics to simulate tree growth by updating tree diameter and tree status (live, dead, or cut): species, tree diameter, crown ratio, site index, stand basal area, and average stand diameter. These characteristics were used to produce growth and mortality rates that were adjusted based on remeasurement plot information and applied to the original tree list to yield an updated tree list. Net volume equations were applied to the original and updated tree lists to estimate volumes of growth and mortality.

3. Under an agreement with the National Forest Eastern Region, North Central Station crews established 10-point variable radius plots on the Hiawatha and Huron-Manistee National Forests in 1976 and the Ottawa National Forest in 1980. National Forest personnel provided the Station with the area of commercial forest land by forest type, stand-size class, and density for the Forest, and the North Central Station computed all volume data in the same manner as the non-National Forest data. Data from the Hiawatha and Huron-Manistee National Forests were updated with STEMS to provide current estimates of volume, growth, removals, and mortality. Area and volume tables were approved by the Forest staff before publication.

4. Statistics on timber utilization during 1978 were obtained from mill surveys. The Michigan Department of Natural Resources canvassed resident sawmills, veneer mills, and other primary wood-using plants. The North Central Forest Experiment Station canvassed out-of-State sawmills, pulpmills, and veneer mills to determine their use of Michigan timber. Fuelwood and fencepost output was based on a sample of public and private landowners to determine their production of fuelwood and fenceposts and on a canvass of industrial and public timber owners. Estimates of primary mill residue used for fuelwood were obtained from the canvass of Michigan primary wood-using plants. Timber cut for products by ownership class was determined by a canvass of public and industrial timber owners. The portion of timber cut unaccounted for by the latter owners was grouped under "farmer and other owners".

5. A total of 2,239 felled trees on 123 active logging operations were measured throughout the State during 1977-1978 to develop wood utilization factors for converting timber products output to timber removals for saw logs and pulpwood. Factors for all other products were obtained during the 1964-1965 Michigan utilization study.

MAKING 1966 AND 1980 DATA COMPATIBLE

Data from new forest inventories are often compared with data from earlier inventories to determine trends in forest resources. Changes in procedures and definitions between surveys make it necessary to adjust earlier survey data so that they are comparable to data from the new survey. A consistency check was made for each Forest Survey Unit in Michigan to ensure that the changes observed between inventories reflected actual changes in the resource and not changes in definitions or procedures.

Changes were made between the 1966 and 1980 Michigan inventories in (1) the definition of ownership classes, (2) the definition of productive-reserved forest land, (3) procedures for determining the area of nonforest land by land class, and (4) volume equations.

In 1966, State Forest was a separate owner class and included only land on State Forests. Other forested State-owned land was included under the Other Public ownership class. In 1980, the State owner class included all State land. However, State-owned commercial forest land outside the State Forest areas is small in Michigan and general comparisons may be made between the 1966 and 1980 State estimates.

Some mining companies were called diversified forest industry in 1966 and classed under the Forest Industry ownership class. In 1980 these companies were classed under Miscellaneous Private Corporation ownership class. Therefore, a comparison of statistics for Forest Industry owner between 1966 and 1980 is possible only if the Forest Industry and Miscellaneous Private Corporation ownerships in 1980 are combined.

[6] *For more information on STEMS, see: Belcher, D. L.,* et al. *1982.*

During the 1966 forest inventory, Christmas tree plantations were classified as commercial forest land whereas they are now classified as productive-reserved forest land. Likewise, sharptail grouse management areas were classified as commercial forest land in 1966 but were classed as productive-reserved in 1980. The 1966 commercial forest and productive-reserved areas were adjusted so that they are comparable to 1980 estimates.

In the 1966 forest inventory, the 1964 Census of Agriculture estimates of cropland, pasture, and rangeland areas were used in our inventory report tables. The 1980 inventory estimates of cropland, pasture, and rangeland come from aerial photointerpretation done by Forest Inventory and Analysis personnel in St. Paul. The published 1966 estimates of these areas were adjusted to be compatible with 1980 estimates.

The procedures used to determine the number of growing-stock trees by species group and 2-inch diameter class have improved between the 1966 and 1980 forest inventories. The procedure used in 1966 overestimated the number of growing-stock trees, especially in the lower diameter classes. The 1966 estimates of number of trees were adjusted so that differences between 1966 and 1980 represent actual changes in the resource, not changes in procedures. Additional adjustments were made in the 1966 number of growing-stock trees to reflect the transfer of Christmas tree plantations to productive-reserved forest land.

The volume equations used in 1980 more accurately estimate tree volume than those used in 1966. Therefore, the 1966 volumes were adjusted by factors derived from the 1980 volume equations to make them comparable to 1980 volumes.

A test was made to ensure that it was possible to move from the adjusted 1966 resource statistics to the 1980 values. This was done using Timber Resource Analysis System (TRAS), a Forest Service computer program for updating, backdating, and projecting timber volume, growth, mortality, and removals. Using the adjusted 1966 numbers of softwood and hardwood trees by 2-inch diameter class and applying 1980 cubic feet per tree estimates, 1966 softwood and hardwood volumes were generated that are comparable with 1980 volumes. Then, using growth rates, mortality rates, and removals rates for the period between the two surveys, TRAS moved the inventory from 1966 to 1980. The program printed out volumes for softwoods and hardwoods by diameter class for each selected year in the period. Thus, inconsistencies in volume, growth, mortality, and removals were identified and resolved.

TRAS generated an estimate of what total removals had to be in order for the inventory to have changed as it did between surveys, given the volume, growth, and mortality data. Estimates of removals for products and for logging residues—two of the three components of total timber removals—were available from an independent utilization study. An estimate of "other" removals (see Definition of Terms in Appendix), the third component of total removals, was made by subtracting the first two removals components from the TRAS-generated total removals estimate. This estimate of "other" removals is compared with findings from remeasurement plots and new plots (stump counts and land use change) to check its validity. When necessary, TRAS was rerun and adjusted until other removals were compatible with the estimate from field data. Total removals were "trend level removals" because the estimate of "other" removals was based on a removals trend line from 1966 to 1980.

LOG GRADE

In Michigan the butt log of every sawtimber tree on every full permanent sample plot was graded for quality. Additionally, all of the logs in a smaller sample of trees throughout the State were graded. The volume yield by log grade for each tree in the latter sample was used to distribute the volume of trees in the former sample into log-grade classes. The resulting volumes by log-grade classes were expanded to provide an estimate for the entire State.

Logs were graded on the basis of external characteristics as indicators of quality. Hardwood species were graded according to Hardwood Log Grades for Standard Lumber".[7] The best 12-foot section of the lowest 16-foot hardwood log, or the best 12-foot upper section if the butt log did not meet minimum log-grade standards, was graded as follows:

[7] *Vaughn, C. L.* et al. *1966.*

Forest Service standard grades for hardwood factory saw logs

Grading factors		Specifications							
		Log grade 1			Log grade 2				Log grade 3
Position in tree		Butts only	Butts and uppers		Butts and uppers				Butts and uppers
Scaling diameter, inches		[1]13-15	16-19	20+	[2]11+		12+		8+
Length without trim, feet			10+		10+	8-9	10-11	12+	8+
Required clear cuttings[3] of each of three best faces[4]	Min. length, feet	7	5	3	3	3	3	3	2
	Max. number	2	2	2	2	2	2	3	No Limit
	Min. proportion of log length required in clear cutting	5/6	5/6	5/6	2/3	3/4	2/3	2/3	1/2
Maximum sweep and crook allowance	For logs with less than one-fourth of end in sound defects		15 percent			30 percent			50 percent
	For logs with more than one-fourth of end in sound defects		10 percent			20 percent			35 percent
Maximum scaling deduction			40 percent[5]			50 percent[6]			50 percent

[1]Ash and basswood butts can be 12 inches if they otherwise meet requirements for small #1's.
[2]Ten-inch logs of all species can be #2 if they otherwise meet requirements for small #1's.
[3]A clear cutting is a portion of a face, extending the width of the face, that is free of defects.
[4]A face is one-fourth of the surface of the log as divided lengthwise.
[5]Otherwise #1 logs with 41-60 percent deductions can be #2.
[6]Otherwise #2 logs with 51-60 percent deductions can be #3.

Forest Service standard specifications for hardwood construction logs (tie and timber logs)[1]

Position in tree		Butt and upper
Min. diameter, small end		8 inches +
Min. length, without trim		8 feet
Clear cuttings		No requirements.
Sweep allowance, absolute		One-fourth of the diameter at the small end for each 8 feet of length.
Sound surface defects	Single knots	Any number, if no one knot has an average diameter above the callus in excess of one-third of the log diameter at point of occurrence.
	Whorled knots	Any number if sum of knot diameters above the callus does not exceed one-third of the log diameter at point of occurrence.
	Holes	Any number provided none has a diameter over one-third of the log diameter at point of occurrence, and none extends more than 3 inches into included timber.[2]
Unsound surface defects		Same requirements as for sound defects if they extend into included timber.[2] No limit if they do not.
End defects	Sound	No requirements.
	Unsound	None allowed; log must be sound internally, but will admit one shake not to exceed one-fourth the scaling diameter and will admit a longitudinal split not extending more than 5 inches into the contained timber.

[1]These specifications are minimum for the class. If, from a group of logs, factory logs are selected first, thus leaving only nonfactory logs from which to select construction logs, then the quality range of the construction logs so selected is limited, and the class may be considered a grade. If selection for construction logs is given first priority, it may be necessary to subdivide the class into grades.

[2]Included timber is always square, and dimension is judged from small end.

Softwood species were graded according to the following specifications on the following page.

Log Grades for Eastern White Pine

Log grade	Minimum size Diameter	Minimum size Length[1]	Sweep or crook allowance	Total cull allowance including sweep	Maximum weevil injury	Allowable knot size (inches)[2] on three best faces or minimum clearness on four faces
	(Inches)	*(Feet)*	*(Percent)*		*(Number)*	*(Inches)*
1	12 & 13	8-16	20	50	0	Four faces clear full length
	14+	10-16	20	50	0	Two faces clear full length, or four faces clear 50 percent length (6 feet min. length)[3]
2	6+	8-16	30	50	0	Sound knots 1.e[4] D/6 and less than 3 inches.[5] Unsound knots: 1.e. 1½ inches and for: butt, logs 1.e. D/12, upper logs 1.e.D/10, or four faces clear 50 percent of length
3	6+	8-16	40	50	8-foot logs: 1 weevil 10-foot+ logs: 2 weevils	Sound knots 1.e.D/3 and less than 5 inches. Unsound knots 1.e. D/6 and less than 2½ inches.
4	6+	8-16	50	50	No limit	No limit

[1]Plus trim.
[2]Disregard all knots less than ½-inch diameter in all grades.
[3]The sum of the diameter of sound knots plus twice the sum of the diameter of unsound knots (in inches) in less than or equal to half of the diameter of the log (inches).
[4]I.e. means less than or equal to.
[5]D means d.i.b. of log at location of knot.

LOG GRADES FOR JACK PINE AND RED PINE

Grade 1: logs with three or four clear faces.[8]

Grade 2: logs with one or two clear faces.

Grade 3: logs with no clear faces.

After the tentative log grade is established, the log will be degraded one grade for each of the following, except that no log can be degraded below grade 3. Net scale after deduction for defect must be at least 50 percent of the gross contents of the log.

1. *Sweep.* Degrade any tentative 1 or 2 log one grade if sweep amounts to 3 or more inches and equals or exceeds one-third the diameter inside bark at small end.

2. *Heart rot.* Degrade any tentative 1 or 2 log one grade if conk, massed hyphae, or other evidence of advanced heart rot is found anywhere in it.

[8]*A face is one fourth of the circumference in width extending full length of the log. Clear faces are those free of: knots measuring more than ½-inch in diameter, overgrown knots of any size, holes more than ¼-inch in diameter. Faces may be rotated to obtain the maximum number of clear ones.*

LOG GRADES FOR ALL OTHER SOFTWOOD LOGS

Grade 1

1. Logs must be 16 inches in diameter or larger, 10 feet in length or longer, and have not more than 30 percent of gross scale deducted for defect.

2. Logs must be at least 75 percent clear on each of three faces.

3. All knots outside clear cutting must be sound and not more than 2½-inches in size.

Grade 2

1. Logs must be 12 inches in diameter or larger, 10 feet in length or longer, and have a net scale of at least 50 percent of the gross contents of the log after deduction for defect.

2. Logs must be at least 50 percent clear on each of three faces or 75 percent clear on two faces.

Grade 3

1. Logs must be 6 inches in diameter or larger, 8 feet in length or longer, and have a net scale of at least 50 percent of the gross contents of the log after deduction for defect.

Note: (A) Diameters are diameter inside bark (d.i.b.) at small end of log.
(B) Percent clear refers to percent clear in one continuous section.

TREE SPECIES GROUPS IN MICHIGAN[9]

SOFTWOODS
- Eastern white pine ..... *Pinus strobus*
- Red pine ..... *Pinus resinosa*
- Jack pine ..... *Pinus banksiana*
- White spruce ..... *Picea glauca*
- Black spruce ..... *Picea mariana*
- Balsam fir ..... *Abies balsamea*
- Eastern hemlock ..... *Tsuga canadensis*
- Tamarack ..... *Larix laricina*
- Northern white-cedar ..... *Thuja occidentalis*
- Other softwoods
  - Eastern redcedar ..... *Juniperus virginiana*
  - Norway spruce ..... *Picea abies*
  - Engelmann spruce ..... *Picea engelmannii*
  - Austrian pine ..... *Pinus nigra*
  - Scotch pine ..... *Pinus sylvestris*

HARDWOODS
- White oaks
  - White oak ..... *Quercus alba*
  - Swamp white oak ..... *Quercus bicolor*
  - Bur oak ..... *Quercus macrocarpa*
  - Chinkapin oak ..... *Quercus muehlenbergii*
  - Chestnut oak ..... *Quercus prinus*
- Select red oak
  - Northern red oak ..... *Quercus rubra*
- Other red oaks
  - Scarlet oak ..... *Quercus coccinea*
  - Northern pin oak ..... *Quercus ellipsoidalis*
  - Pin oak ..... *Quercus palustris*
  - Black oak ..... *Quercus velutina*
- Hickories
  - Bitternut hickory ..... *Carya cordiformis*
  - Pignut hickory ..... *Carya glabra*
  - Shellbark hickory ..... *Carya laciniosa*
  - Shagbark hickory ..... *Carya ovata*
  - Mockernut hickory ..... *Carya tomentosa*
- Yellow birch ..... *Betula alleghaniensis*
- Hard maples
  - Sugar maple ..... *Acer saccharum*
  - Black maple ..... *Acer nigrum*
- Soft maples
  - Red maple ..... *Acer rubrum*
  - Silver maple ..... *Acer saccharinum*
- American beech ..... *Fagus grandifolia*
- Ashes
  - White ash ..... *Fraxinus americana*
  - Black ash ..... *Fraxinus nigra*
  - Green ash ..... *Fraxinus pennsylvanica*
- Balsam poplar ..... *Populus balsamifera*
- Eastern cottonwood ..... *Populus deltoides*
- Aspens
  - Bigtooth aspen ..... *Populus grandidentata*
  - Quaking aspen ..... *Populus tremuloides*
- American basswood ..... *Tilia americana*
- Yellow-poplar ..... *Liriodendron tulipifera*
- Black walnut ..... *Juglans nigra*
- Black cherry ..... *Prunus serotina*
- Butternut ..... *Juglans cinerea*
- Elms
  - American elm ..... *Ulmus americana*
  - Slippery elm ..... *Ulmus rubra*
  - Rock elm ..... *Ulmus thomasii*
- Paper birch ..... *Betula papyrifera*
- Other hardwoods
  - Boxelder ..... *Acer negundo*
  - Sweet birch ..... *Betula lenta*
  - River birch ..... *Betula nigra*
  - Black willow ..... *Salix nigra*
  - Ohio buckeye ..... *Aesculus glabra*
  - Flowering dogwood ..... *Cornus florida*
  - Honeylocust ..... *Gleditsia triacanthos*
  - Osage-orange ..... *Maclura pomifera*
  - Black tupelo .... *Nyssa sylvatica* var. *sylvatica*
  - Sycamore ..... *Platanus occidentalis*
  - Black locust ..... *Robinia pseudoacacia*
  - Sassafras ..... *Sassafras albidum*
  - Red mulberry ..... *Morus rubra*
  - American chestnut ..... *Castanea dentata*

[9] *The common and scientific names are based on, Little, Elbert L., 1979.*

METRIC EQUIVALENTS OF UNITS USED IN THIS REPORT

1 acre = 4,046.86 square meters or 0.405 hectare.
1,000 acres = 405 hectares.
Breast height = 1.4 meters above the ground.
1 cubic foot = 0.0283 cubic meter.
1 inch = 25.4 millimeters, 2.54 centimeters, or 0.0254 meter.
1 foot = 30.48 centimeters or 0.3048 meter.
1 pound = 0.454 kilogram.
1 ton = 0.907 metric ton.

DEFINITION OF TERMS

Acceptable trees.—Growing-stock trees of commercial species that meet specified standards of size and quality but do not qualify as desirable trees.

Area-condition classes.—*Class 10.*—Areas fully stocked with desirable trees but not overstocked.

Class 20.—Areas fully stocked with desirable trees but overstocked with all live trees.

Class 30.—Areas medium to fully stocked with desirable trees and with less than 30 percent of the area controlled by other trees and/or inhibiting vegetation or surface conditions that will prevent occupancy by desirable trees.

Class 40.—Areas medium to fully stocked with desirable trees and with 30 percent or more of the area controlled by other trees and/or conditions that ordinarily prevent occupancy by desirable trees.

Class 50.—Areas poorly stocked with desirable trees but fully stocked with growing-stock trees.

Class 60.—Areas poorly stocked with desirable trees but with medium to full stocking of growing-stock trees.

Class 70.—Areas poorly stocked with desirable trees and poorly stocked with growing-stock trees.

Basal area.—The area in square feet of the cross section at breast height of a single tree. When the basal area of all trees in a stand are summed, the result is usually expressed as square feet of basal area per acre.

Biomass.—The above-ground volume of all live trees (including bark and foliage) reported in green tons. Biomass is made up of 5 components:

Growing-stock bole.—Biomass of a growing-stock tree from a 1-foot stump to a variable 4-inch top.

Growing-stock tops and limbs.—Biomass of a growing-stock tree from a 1-foot stump minus the growing-stock bole.

Cull bole.—Biomass of a cull tree from a 1-foot stump to a variable 4-inch top.

Cull tops and limbs.—Biomass of a cull tree from a 1-inch stump minus the cull bole.

1- to 5-inch trees.—Biomass of all live trees 1- to 5-inches in diameter at breast height.

Commercial forest land.—Forest land producing or capable of producing crops of industrial wood and not withdrawn from timber utilization. (Note: Areas qualifying as commercial forest land have the capability of producing in excess of 20 cubic feet per acre per year of annual growth under management. Currently inaccessible and inoperable areas are included, except when the areas involved are small and unlikely to become suitable for production of industrial wood in the foreseeable future.) Also see definition of pastured commercial forest land.

Commercial species.—Tree species presently or prospectively suitable for industrial wood products. (Note: Excludes species of typically small size, poor form, or inferior quality such as hophornbeam and hawthorn.)

County and municipal land.—Lands owned by counties and local public agencies or municipalities, or lands leased to these governmental units for 50 years or more.

Cull.—Portions of a tree that are unusable for industrial wood products, because of rot, form, or other defect.

Desirable trees.—Growing-stock trees having no serious defects in quality limiting present or prospective use, and of relatively high vigor, and containing no pathogens that may result in death or serious deterioration before rotation age. These are trees that would be favored by forest managers in silvicultural operations.

Diameter classes.—A classification of trees based on diameter outside bark, measured at breast height (4-½ feet above the ground). (Note: d.b.h. is the common abbreviation for diameter at breast height. Two-inch diameter classes are commonly used in Forest Inventory and Analysis tables, with the even inch the approximate midpoint for a class. For example, the 6-inch class includes trees 5.0 through 6.9 inches d.b.h. inclusive).

Farm.—Any land from which $1,000 or more of agricultural products were grown and sold or normally would have been sold during the year.

Farmer-owned land.—Land owned by farm operators. (Note: Excludes land leased by farm operators from nonfarm owners, such as railroad companies and States.)

Forest land.—Land at least 16.7 percent stocked by forest trees of any size, or formerly having had such tree cover, and not currently developed for nonforest use. (Note: Stocking is measured by comparison of basal area and/or number of trees, by age or size and spacing with specified standards.) The minimum area for classification of forest land is 1 acre. Roadside, streamside, and shelterbelt strips of timber must have a crown width of at least 120 feet to qualify as forest land. Unimproved roads and trails, streams, or other bodies of water or clearings in forest areas shall be classed as forest if less than 120 feet wide. Also see definitions for land area, commercial forest land, noncommercial forest land, productive-reserved forest land, stocking, unproductive forest land, and water.

Forest industry land.—Land owned by companies or individuals operating primary wood-using plants.

Forest trees.—Woody plants having a well-developed stem and usually more than 12 feet in height at maturity.

Forest type.—A classification of forest land based upon the species forming a plurality of live tree

stocking. Major forest types in Michigan are:

Jack pine.—Forests in which jack pine comprises a plurality of the stocking. (Common associates include eastern white pine, red pine, aspen, birch, and maple.)

Red pine.—Forests in which red pine comprises a plurality of the stocking. (Common associates include eastern white pine, jack pine, aspen, birch, and maple.)

White pine.—Forests in which eastern white pine comprises a plurality of the stocking. (Common associates include red pine, jack pine, aspen, birch, and maple.)

Balsam fir.—Forests in which balsam fir and white spruce comprise a plurality of stocking with balsam fir the most common. (Common associates include white spruce, aspen, maple, birch, northern white-cedar, and tamarack.)

White spruce.—Forests in which white spruce and balsam fir comprise a plurality of the stocking with white spruce the most common. (Common associates include balsam fir, aspen, maple, birch, northern white-cedar, and tamarack.)

Black spruce.—Forests in which swamp conifers comprise a plurality of the stocking with black spruce the most common. (Common associates include tamarack and northern white-cedar.)

Northern white-cedar.—Forests in which swamp conifers comprise a plurality of the stocking with northern white-cedar the most common. (Common associates include tamarack and black spruce.)

Tamarack.—Forests in which swamp conifers comprise a plurality of the stocking with tamarack the most common. (Common associates include black spruce and northern white-cedar.)

Oak-hickory.—Forests in which northern red oak, white oak, bur oak, or hickories, singly or in combination, comprise a plurality of the stocking. (Common associates include jack pine, beech, yellow-poplar, elm, and maple.)

Elm-ash-soft maple.—Forests in which lowland elm, ash, cottonwood, and red maple, singly or in combination, comprise a plurality of the stocking. (Common associates include birches, spruce, and balsam fir.)

Maple-birch—Forests in which sugar maple, basswood, yellow birch, upland American elm, and red maple, singly or in combination, comprise a plurality of the stocking. (Common associates include white pine, elm, hemlock, and basswood.)

Aspen.—Forests in which quaking aspen or bigtooth aspen, singly or in combination, comprise a plurality of the stocking. (Common associates include balsam poplar, balsam fir, and paper birch.)

Paper birch.—Forests in which paper birch comprises a plurality of the stocking. (Common associates include maple, aspen, and balsam fir.)

Exotic.—Forests in which species not native to Michigan comprise a plurality of the stocking. (Mostly scotch pine plantations.)

Gross area.—The entire area of land and water as determined by the Bureau of the Census, 1970.

Growing-stock trees.—Live trees of commercial species qualifying as desirable and acceptable trees. (Note: Excludes rough, rotten, and dead trees.)

Growing-stock volume.—Net volume in cubic feet of growing-stock trees 5.0 inches d.b.h. and over, from a 1-foot stump to a minimum 4.0 inch top diameter outside bark of the central stem or to the point where the central stem breaks into limbs. Cubic feet can be converted to cords by dividing by 79 cubic feet per solid wood cord.

Hardwoods.—Dicotyledonous trees, usually broad-leaved and deciduous.

Idle farmland.—Includes former croplands, orchards, improved pastures, and farm sites not tended within the past 2 years and presently less than 16.7 percent stocked with trees.

Improved pasture.—Land currently improved for grazing by cultivation, seeding, irrigation, or clearing of trees or brush and less than 16.7 percent stocked with live trees.

Indian land.—Tribal lands held in fee but administered by the Federal Government.

Land area.—A. *Bureau of the Census.* The area of dry land and land temporarily or partly covered by water, such as marshes, swamps, and river flood plains (omitting tidal flats below mean high tide); streams, sloughs, estuaries, and canals less than one-eighth of a statute mile wide; and lakes, reservoirs, and ponds less than 40 acres in area.

B. *Forest Inventory and Analysis.* The same as the Bureau of the Census, except minimum width of streams, etc. is 120 feet and minimum size of lakes, etc. is 1 acre.

Live trees.—Growing-stock and rough and rotten trees 1 inch d.b.h. and larger.

Log grades.—A classification of logs based on external characteristics as indicators of quality or value. (See Appendix for specific grading factors used.)

Logging residues.—The unused growing-stock portions of trees cut or killed by logging.

Maintained road.—Any road, hard-topped or other surfaces, that is plowed or graded at least once a year. Includes rights-of-way that are cut or treated to limit herbaceous growth.

Marsh.—Nonforest land that characteristically supports low, generally herbaceous or shrubby vegetation and that is intermittently covered with water.

Merchantable.—Refers to a pulpwood or saw log section that meets pulpwood or saw log specifications, respectively.

Miscellaneous federal land.—Federal land other than National Forest and land administered by the Bureau of Land Management.

Miscellaneous private land.—Privately owned land other than forest-industry and farmer-owned land.

Mortality.—The volume of sound wood in growing-stock and sawtimber trees that die annually.

National Forest land.—Federal land that has been legally designated as National Forest or purchase units, and other land under the administration of the USDA Forest Service.

Net annual growth of growing stock.—The annual change in volume of sound wood in live sawtimber and poletimber trees and the total volume of trees entering these classes through ingrowth, less volume losses resulting from natural causes.

Net annual growth of sawtimber.—The annual change in the volume of live sawtimber trees and the total volume of trees reaching sawtimber size, less volume losses resulting from natural causes.

Net volume.—Gross volume less deductions for rot, sweep, or other defect affecting use for timber products.

Noncommercial forest land.—(a) Unproductive forest land and (b) productive-reserved forest land.

Noncommercial species.—Tree species of typically small size, poor form, or inferior quality which normally do not develop into trees suitable for industrial wood products.

Nonforest land.—Land that has never supported forests, and land formerly forested where use for timber management is precluded by development for other uses. (Note: Includes areas used for crops, improved pasture, residential areas, city parks, improved roads of any width and adjoining clearings, powerline clearings of any width, and 1- to 40-acre areas of water classified by the Bureau of the Census as land. If intermingled in forest areas, unimproved roads and nonforest strips must be more than 120 feet wide and more than 1 acre in area, to qualify as nonforest land.)

a. *Nonforest land without trees.*—Nonforest land with no live trees present.

b. *Nonforest land with trees.*—Nonforest land with one or more trees per acre at least 5 inches d.b.h.

Nonstocked land.—Commercial forest land less than 16.7 percent stocked with growing-stock trees.

Other removals.—Growing-stock trees removed but not utilized for products, or trees left standing but "removed" from the commercial forest land classification by land use change. Examples are removals from cultural operations such as timber stand improvement work, land clearing, and changes in land use.

Ownership.—Property owned by one owner, regardless of the number of parcels in a specified area.

Ownership size class.—The amount of commercial forest land owned by one owner, regardless of the number or parcels.

Owner tenure.—The length of time a property has been held by the owner.

Physiographic class.—A measure of soil and water conditions that affect tree growth on a site. The physiographic classes are:

Xeric sites.—Very dry soils where excessive drainage seriously limits both growth and species occurrence. Example: sandy jack pine plains.

Xeromesic sites.—Moderately dry soils where excessive drainage limits growth and species occurrence to some extent. Example: dry oak ridge.

Mesic sites.—Deep, well-drained soils. Growth and species occurrence are limited only by climate.

Hydromesic sites.—Moderately wet soils where insufficient drainage or infrequent flooding limits growth and species occurrence to some extent. Example: better drained bottomland hardwood sites.

Hydric sites.—Very wet sites where excess water seriously limits both growth and species occurrence. Example: wet, frequently flooded river bottoms and spruce bogs.

Plant byproducts.—Plant residues used for products such as mulch, pulp chips, and fuelwood.

Plant residues.—Wood and bark materials generated at manufacturing plants during production of other products.

Poletimber stands.—(See stand-size class.)

Poletimber trees.—Growing-stock trees of commercial species at least 5.0 inches d.b.h., but smaller than sawtimber size.

Productive-reserved forest land.—Forest land sufficiently productive to qualify as commercial forest land but withdrawn from timber utilization through statute, administration regulation, designation, or exclusive use for Christmas tree production, as indicated by annual shearing.

Rotten trees.—Live trees of commercial species that do not contain at least one 12-foot saw log or two saw logs 8 feet or longer, now or prospectively, and/or do not meet Regional specifications for freedom from defect primarily because of rot; that is, when more than 50 percent of the cull volume in a tree is rotten.

Rough trees.—(a) Live trees of commercial species that do not contain at least one merchantable 12-foot saw log or two saw logs 8 feet or longer, now or prospectively, and/or do not meet Regional specifications for freedom from defect primarily because of roughness or poor form, and (b) all live trees of noncommercial species.

Roundwood products.—Logs, bolts, or other round sections (including chips from roundwood) cut from trees for industrial or consumer uses. (Note: Includes saw logs, veneer logs and bolts; cooperage logs and bolts; pulpwood; fuelwood; piling; poles; posts; hewn ties; mine timbers; and various other round, split, or hewn products.)

Salvable dead trees.—Standing or down dead trees that are considered merchantable by Regional standards.

Saplings.—Live trees 1 to 5 inches d.b.h.

Sapling-seedling stands.—(See stand-size class.)

Saw log.—A log meeting minimum standards of diameter, length, and defect, including logs at least 8 feet long, sound and straight and with a minimum diameter outside bark (d.o.b.) for softwoods of 7 inches (9 inches for hardwoods) or other combinations of size and defect specified by Regional standards.

Saw log portion.—That part of the bole of sawtimber trees between the stump and the saw log top.

Saw log top.—The point on the bole of sawtimber trees above which a saw log cannot be produced. The minimum saw log top is 7 inches d.o.b. for softwoods and 9 inches d.o.b. for hardwoods.

Sawtimber stands.—(See stand-size class.)

Sawtimber trees.—Growing-stock trees of commercial species containing at least a 12-foot saw log or two noncontiguous saw logs 8 feet or longer, and meeting Regional specifications for freedom from defect. Softwoods must be at least 9 inches d.b.h. Hardwoods must be at least 11 inches d.b.h.

Sawtimber volume.—Net volume of the saw log portion of live sawtimber trees in board feet, International 1/4-inch rule, from stump to a minimum 7 inches top diameter outside bark (d.o.b.) for softwoods and a minimum 9 inches top d.o.b. for hardwoods.

Seedlings.—Live trees less than 1 inch d.b.h. that are expected to survive. Only softwood seedlings more than 6 inches tall and hardwood seedlings more than 1 foot tall are counted.

Short-log (rough tree).—Sawtimber-size trees of commercial species that contain at least one merchantable 8- to 11-foot saw log but not a 12-foot saw log.

Shrub.—A woody, perennial plant differing from a perennial herb in its persistent and woody stem(s), and less definitely from a tree in its lower stature and the general absence of a well-defined main stem. For this report shrubs were separated somewhat arbitrarily into tall and low shrubs as follows:

Tall shrubs.—Shrubs whose normal height is usually greater than 1.6 to 3.2 feet (0.5 to 1.0 meter).

Low shrubs.—Shrubs whose normal height is usually less than 1.6 to 3.2 feet (0.5 to 1.0 meter). (Woody perennial vines, such as grape, may be included with low shrubs).

Shrub biomass.—The total above-ground weight (including the bark) of selected shrubs and trees less than 1 inch d.b.h.

Site class.—A classification of forest land in terms of inherent capacity to grow crops of industrial wood based on fully stocked natural stands.

Site index.—An expression of forest site quality based on the height of a free-growing dominant or codominant tree of a representative species in the forest type at age 50.

Softwoods.—Coniferous trees, usually evergreen, having needles or scale-like leaves.

Stand.—A growth of trees on a minimum of 1 acre of forest land that is stocked by forest trees of any size.

Stand-age class.—Age of the main stand. Main stand refers to trees of the dominant forest type and stand-size class.

Stand-area class.—The extent of a continuous forested area of the same forest type, stand-size class, and stand-density class.

Stand-size class.—A classification of forest land based on the size class of growing-stock trees on the area; that is, sawtimber, poletimber or seedlings and saplings.

a. *Sawtimber stands.*—Stands at least 16.7 percent stocked with growing-stock trees, with half or more of total stocking in sawtimber or poletimber trees, and with sawtimber stocking at least equal to poletimber stocking.

b. *Poletimber stands.*—Stands at least 16.7 percent stocked with growing-stock trees of which half or more of this stocking is in poletimber and/or sawtimber trees, and with poletimber stocking exceeding that of sawtimber.

c. *Sapling-seedling stands.*—Stands at least 16.7 percent stocked with growing-stock trees of which more than half of the stocking is saplings and/or seedlings.

d. *Nonstocked stands.*—Stands in which stocking of growing-stock trees is less than 16.7 percent.

State land.—Land owned by States, or land leased to these governmental units for 50 years or more.

Stocking.—The degree of occupancy of land by trees, measured by basal area and/or the number of trees in a stand by size or age and spacing, compared to the basal area and/or number of trees required to fully utilize the growth potential of the land; that is, the stocking standard.

A stocking percent of 100 indicates full utilization of the site and is equivalent to 80 square feet of basal area per acre in trees 5 inches d.b.h. and larger. In a stand of trees less than 5 inches d.b.h., a stocking percent of 100 would indicate that the present number of trees is sufficient to produce 80 square feet of basal area per acre when the trees reach 5 inches d.b.h.

Stands are grouped into the following stocking classes:

Overstocked stands.—Stands in which stocking of trees is 134.0 percent or more.

Fully stocked stands.—Stands in which stocking of trees is from 101.0 to 133.9 percent.

Medium stocked stands.—Stands in which stocking of trees is from 61.0 to 100.9 percent.

Poorly stocked stands.—Stands in which stocking of trees is from 16.7 to 60.9 percent.

Nonstocked areas.—Commercial forest land on which stocking of trees is less than 16.7 percent.

Timber removals from growing stock.—The volume of sound wood in growing-stock trees removed annually for forest products (including roundwood products and logging residues) and for other removals.

Timber removals from sawtimber.—The net board-foot volume of live sawtimber trees removed for forest products annually (including roundwood products and logging residues) and for other removals.

Timber products output.—All timber products cut from roundwood and byproducts of wood manufacturing plants. Roundwood products include logs, bolts, or other round sections cut from growing-stock trees, cull trees, salvable dead trees, trees on nonforest land, noncommercial species, sapling-size trees, and limbwood. Byproducts from primary manufacturing plants include slabs, edgings, trimmings, miscuts, sawdust, shavings, veneer cores and clippings, and screenings of pulpmills that are used as pulpwood chips or other products.

Tree biomass.—The total aboveground weight (including the bark) of all trees 1 to 5 inches in d.b.h., and the total aboveground weight (including the bark) from a 1-foot stump for trees more than 5 inches in diameter.

Tree size class.—A classification of trees based on diameter at breast height, including sawtimber trees, poletimber trees, saplings, and seedlings.

Unproductive forest land.—Forest land incapable of producing 20 cubic feet per acre of annual growth or of yielding crops of industrial wood under natural conditions because of adverse site conditions. (Note: Adverse conditions include shallow soils, dry climate, poor drainage, high elevation, steepness, and rockiness.)

Upper stem portion.—That part of the bole of sawtimber trees above the saw log top to a minimum top diameter of 4 inches outside bark or to the point where the central stem breaks into limbs.

Urban and other areas.—Areas within the legal boundaries of cities and towns; suburban areas developed for residential, industrial, or recreational purposes; schoolyards, cemeteries, roads; railroads; airports; beaches; powerlines; and other rights-of-way; or other nonforest land not included in any other specified land use class.

Water.—(a) *Bureau of the Census.*—Streams, sloughs, estuaries, and canals more than one-eighth of a statute mile wide; and lakes, reservoirs, and ponds more than 40 acres in area.

(b) *Noncensus.*—The same as the Bureau of the Census, except minimum width of streams, etc. is 120 feet and minimum size of lakes, etc. is 1 acre.

Wooded pasture.—Improved pasture with more than 16.7 percent stocking in live trees but less than 25 percent stocking in growing-stock trees. Area is currently improved for grazing or there is other evidence of grazing.

Wooded strip.—An acre or more of natural continuous forest land that would otherwise meet survey standards for commercial forest land except that it is less than 120 feet wide.

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(In million cubic feet)

Species group	1966[1/]	1980
SOFTWOODS		
White pine	384.6	543.6
Red pine	287.0	713.9
Jack pine	392.8	628.2
White spruce	272.5	396.7
Black spruce	257.0	343.5
Balsam fir	740.4	780.8
Hemlock	519.1	486.7
Tamarack	84.7	108.2
Northern white-cedar	1,056.9	1,297.9
Other softwoods	5.8	56.1
Total	4,000.8	5,355.6
HARDWOODS		
Select white oak	440.3	561.6
Select red oak	740.9	1,166.2
Other red oak	416.5	291.0
Hickory	102.8	105.5
Yellow birch	510.6	466.6
Hard maple	2,275.3	2,748.8
Soft maple	1,266.7	2,252.8
Beech	409.5	337.9
Ash	502.2	677.2
Balsam poplar	174.4	240.7
Cottonwood	73.7	70.6
Bigtooth aspen	673.9	903.4
Quaking aspen	1,448.9	1,714.0
Basswood	463.5	668.3
Yellow-poplar	8.0	19.4
Black walnut	3.2	26.8
Black cherry	162.8	313.7
Butternut	--	3.7
Elm	692.3	278.3
Paper birch	631.8	813.8
Other hardwoods	51.9	87.9
Total	11,049.2	13,748.2
All species	15,050.0	19,103.8

[1/] Figures have been adjusted from those published after the 1966 survey to conform to 1980 volumes because of changes in survey definitions and procedures.

Table 8.--Net volume of all live trees on commercial forest land by species group and diameter class, Michigan, 1980

(In thousand cubic feet)

Species group	All classes	Diameter class (inches at breast height) 5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS													
White pine	560,093	25,794	40,539	52,556	54,779	77,221	67,902	62,448	51,446	44,909	65,386	16,638	475
Red pine	720,491	184,272	185,287	108,192	77,163	49,566	50,313	33,317	18,697	9,231	4,453	--	--
Jack pine	650,001	168,312	221,015	155,730	61,083	28,974	10,069	4,345	365	108	--	--	--
White spruce	404,068	55,072	68,520	90,609	69,252	55,360	32,560	19,270	6,783	3,722	2,920	--	--
Black spruce	346,427	163,621	107,436	44,629	16,006	5,595	3,198	762	5,180	--	--	--	--
Balsam fir	794,962	302,866	248,720	143,844	67,886	21,596	7,792	1,514	--	--	744	--	--
Hemlock	524,783	25,206	45,134	59,319	77,255	86,151	77,983	51,424	39,868	27,012	30,787	4,558	86
Tamarack	112,877	41,034	29,543	24,310	10,017	4,607	2,662	317	68	319	--	--	--
Northern white-cedar	1,454,692	419,634	377,810	265,909	166,975	100,490	56,160	28,879	15,957	10,214	10,377	1,975	312
Other softwoods	63,831	30,983	17,890	8,666	3,450	2,671	52	--	119	--	--	--	--
Total	5,632,225	1,416,794	1,341,894	953,764	603,866	432,231	308,691	202,276	138,483	95,515	114,667	23,171	873
HARDWOODS													
Select white oaks	594,196	66,867	89,964	91,532	81,483	61,412	59,494	42,108	31,014	19,207	31,175	16,715	3,225
Select red oaks	1,219,008	88,843	161,254	214,263	202,330	165,773	132,186	97,008	59,549	38,808	47,053	11,354	587
Other red oaks	311,800	31,060	45,095	55,425	53,994	39,196	29,766	26,519	9,963	7,355	10,512	2,915	--
Hickory	108,551	8,177	17,430	24,613	20,797	14,277	8,816	6,691	2,885	2,325	1,680	396	464
Yellow birch	574,515	58,919	77,035	79,871	70,705	75,386	64,020	47,448	31,720	22,950	31,366	11,627	3,468
Hard maple	2,960,143	529,470	564,421	492,055	369,124	302,233	258,381	179,063	108,503	53,464	77,899	22,562	2,968
Soft maple	2,437,840	453,807	522,816	446,715	328,429	240,164	159,488	101,029	65,717	37,142	52,829	20,536	9,168
Beech	404,636	38,943	43,337	48,940	51,499	62,612	52,194	42,711	25,912	15,904	20,077	2,507	--
Ash	714,225	155,726	139,413	130,297	101,034	70,132	48,245	28,017	16,147	8,767	12,287	3,429	731
Balsam poplar	252,236	21,518	36,453	39,387	42,746	40,877	30,595	17,611	11,837	6,734	3,130	1,348	--
Cottonwood	71,861	3,502	4,451	9,397	6,817	7,237	10,182	4,044	5,386	5,393	8,050	5,204	2,198
Bigtooth aspen	955,512	122,681	210,333	245,224	192,317	102,581	45,931	22,057	7,241	4,097	3,050	--	--
Quaking aspen	1,887,212	290,235	426,547	440,874	351,412	199,153	107,063	45,038	19,434	5,408	1,583	465	--
Basswood	698,091	77,926	130,199	155,313	122,743	85,142	54,780	33,190	16,928	9,269	9,255	1,704	1,642
Yellow-poplar	19,425	1,065	1,337	1,295	1,950	2,982	3,209	879	4,016	1,757	935	--	--
Black walnut	27,846	2,491	2,776	5,063	3,590	4,380	4,423	1,633	1,052	1,228	619	591	--
Black cherry	366,824	64,689	89,910	74,701	57,428	39,940	19,225	10,126	5,691	3,675	926	513	--
Butternut	4,844	639	1,002	892	495	955	180	170	--	177	334	--	--
Elm	302,534	60,783	63,031	51,237	43,518	33,423	19,087	12,941	8,879	3,049	3,886	2,584	116
Paper birch	873,794	219,761	262,840	197,062	110,836	47,885	23,092	7,070	2,801	1,374	960	113	--
Other hardwoods	105,271	19,624	15,390	16,702	9,665	10,221	7,484	2,826	5,240	2,959	8,823	5,226	1,111
Noncommercial species	79,629	37,878	22,110	11,518	4,081	2,416	348	338	738	202	--	--	--
Total	14,969,993	2,354,604	2,927,144	2,832,376	2,226,993	1,608,377	1,138,189	728,517	440,653	251,244	326,429	109,789	25,678
All species	20,602,218	3,771,398	4,269,038	3,786,140	2,830,859	2,040,608	1,446,880	930,793	579,136	346,759	441,096	132,960	26,551

Table 9.--Net volume of timber on commercial forest land by class of timber and softwoods and hardwoods, Michigan, 1980

(In thousand cubic feet)

Class of timber	All species	Softwoods	Hardwoods
LIVE TREES			
Growing-stock trees			
Sawtimber			
Saw log portion	7,667,408	2,389,052	5,278,356
Upper stem portion	1,262,675	320,030	942,645
Subtotal	8,930,083	2,709,082	6,221,001
Poletimber	10,173,717	2,646,517	7,527,200
Total	19,103,800	5,355,599	13,748,201
Cull trees			
Rough and rotten cull trees			
Sawtimber	516,866	106,336	410,530
Poletimber	695,122	112,176	582,946
Subtotal	1,211,988	218,512	993,476
Short-log trees	286,430	58,114	228,316
Total	1,498,418	276,625	1,221,793
TOTAL LIVE TREES	20,602,218	5,632,225	14,969,993
SALVABLE DEAD TREES	627,545	224,256	403,289
ALL CLASSES	21,229,763	5,856,481	15,373,282

Table 10.--Net volume of growing stock, sawtimber, short-log, and rough and rotten trees on commercial forest land by individual species, Michigan, 1980

Species	Total all live	Growing stock	Short-log cull	Rough and rotten cull	Sawtimber
	- - - - - - -	-Thousand cubic feet-	- - - - - - - -		Thousand board feet[1/]
SOFTWOODS					
White pine	560,093	543,535	4,499	12,059	2,606,707
Red pine	720,491	713,841	696	5,954	1,890,783
Jack pine	650,001	628,201	3,797	18,003	1,300,487
Scotch pine	55,617	49,638	227	5,752	65,036
Austrian pine	6,728	5,071	155	1,502	2,385
White spruce	404,068	396,698	1,592	5,778	1,395,518
Norway spruce	498	498	--	--	--
Engelmann spruce	81	81	--	--	--
Black spruce	346,427	343,499	360	2,568	364,731
Balsam fir	794,962	780,816	2,743	11,403	1,086,763
Hemlock	524,783	486,735	12,079	25,969	2,389,793
Tamarack	112,877	108,188	515	4,174	191,493
Northern white cedar	1,454,692	1,297,942	31,451	125,299	2,648,562
Eastern redcedar	907	856	--	51	3,261
Total	5,632,225	5,355,599	58,114	218,512	13,945,519
HARDWOODS					
White oak	531,510	502,387	7,055	22,068	1,542,569
Bur oak	18,961	17,447	649	865	74,940
Swamp white oak	43,165	41,317	284	1,564	173,564
Chestnut oak	112	--	--	112	--
Chinkapin oak	448	448	--	--	--
Northern red oak	1,219,009	1,166,227	16,311	36,471	3,903,389
Scarlet oak	2,580	2,391	--	189	3,888
Northern pin oak	66,164	63,521	807	1,836	197,118
Pin oak	1,580	1,580	--	--	4,228
Black oak	241,475	223,544	2,949	14,982	725,930
Bitternut hickory	36,180	35,035	251	894	96,731
Shellbark hickory	3,603	3,418	--	185	11,290
Shagbark hickory	52,315	50,831	703	781	164,711
Mockernut hickory	3,128	3,128	--	--	11,066
Pignut hickory	13,324	13,057	202	65	47,773
Yellow birch	574,515	466,546	28,097	79,872	1,516,165
Black maple	904	699	--	205	3,166
Sugar maple	2,959,238	2,748,073	53,501	157,664	6,994,696
Red maple	2,285,162	2,109,068	34,003	142,091	4,342,198
Silver maple	152,679	143,684	1,288	7,707	471,028
Beech	404,636	337,921	14,703	52,012	1,240,413
White ash	382,040	370,065	4,617	7,358	990,737
Black ash	263,535	243,469	1,503	18,563	342,237
Green ash	68,650	63,697	1,591	3,362	136,195
Balsam poplar	252,236	240,668	1,691	9,877	811,808
Eastern cottonwood	71,862	70,608	92	1,162	291,306
Bigtooth aspen	955,513	903,436	8,056	44,021	1,842,998
Quaking aspen	1,887,213	1,713,956	21,989	151,268	3,460,406
Basswood	698,092	668,337	6,136	23,619	1,772,951
Hackberry	679	679	--	--	2,391
American elm	279,846	257,874	4,689	17,283	604,467
Slippery elm	14,381	13,425	--	956	19,598
Rock elm	8,306	6,955	135	1,216	8,891
Paper birch	873,794	813,842	8,451	51,501	910,295
Chestnut	296	110	--	186	--
Black tupelo	2,865	2,430	--	435	4,357
Sycamore	13,416	13,228	--	188	56,740
Butternut	4,844	3,662	--	1,182	8,952
Black walnut	27,846	26,773	288	785	84,707
Black cherry	366,822	313,738	6,053	47,031	593,837
Yellow-poplar	19,425	19,425	--	--	87,069
Boxelder	6,850	4,981	336	1,533	3,676
Ohio buckeye	393	393	--	--	665
Sweet birch	104	104	--	--	--
River birch	336	336	--	--	878
Flowering dogwood	696	--	--	696	--
Honeylocust	1,518	1,425	--	93	--
Osage orange	329	329	--	--	--
Red mulberry	694	97	--	597	--
Black locust	3,099	2,790	--	309	4,328
Black willow	36,328	30,122	1,705	4,501	120,166
Sassafras	37,668	30,925	181	6,562	39,099
Noncommercial species	79,629	--	--	79,629	--
Total	14,969,993	13,748,201	228,316	993,476	33,723,617
All species	20,602,218	19,103,800	286,430	1,211,988	47,669,136

[1/] International 1/4-inch rule.

Table 11.--Net volume of noncommercial species on commercial forest land by individual species, Michigan, 1980

(In thousand cubic feet)

Species	Cull volume
Striped maple	1,771
Mountain maple	3,078
Ailanthus	540
American hornbeam	1,186
Eastern hophornbeam	56,959
Eastern redbud	--
Hawthorn	3,801
Apple	5,669
Pin cherry	2,317
Chokecherry	2,288
Mountain ash	1,434
Peachleaf willow	586
Diamond willow	--
All species	79,629

Table 12.--Net volume of growing stock on commercial forest land by species group and Forest Survey Unit, Michigan, 1980

(In thousand cubic feet)

Species group	All Units	Forest Survey Unit: Eastern Upper Peninsula	Western Upper Peninsula	Northern Lower Peninsula	Southern Lower Peninsula
SOFTWOODS					
White pine	543,535	146,073	153,771	176,763	66,928
Red pine	713,841	138,860	73,688	452,495	48,798
Jack pine	628,201	174,266	104,739	335,918	13,278
White spruce	396,698	148,642	207,633	38,705	1,718
Black spruce	343,499	170,997	136,530	35,972	--
Balsam fir	780,816	259,257	405,475	115,899	185
Hemlock	486,735	133,434	281,531	64,960	6,810
Tamarack	108,188	42,467	34,916	26,795	4,010
Northern white-cedar	1,297,942	532,848	330,049	431,116	3,929
Other softwoods	56,144	1,440	337	28,428	25,939
Total	5,355,599	1,748,284	1,728,669	1,707,051	171,595
HARDWOODS					
Select white oaks	561,599	358	769	251,160	309,312
Select red oaks	1,166,227	21,707	85,076	721,458	337,986
Other red oaks	291,036	--	--	180,189	110,847
Hickory	105,470	--	--	1,838	103,632
Yellow birch	466,546	99,743	321,572	37,604	7,627
Hard maple	2,748,772	536,418	1,404,710	692,984	114,660
Soft maple	2,252,752	477,453	628,509	748,355	398,435
Beech	337,921	168,298	488	121,689	47,446
Ash	677,231	66,641	130,790	251,892	227,908
Balsam poplar	240,668	89,733	42,799	98,083	10,053
Cottonwood	70,608	368	73	10,261	59,906
Bigtooth aspen	903,436	66,570	104,484	653,639	78,743
Quaking aspen	1,713,956	363,836	643,017	630,943	76,160
Basswood	668,337	50,367	209,228	325,173	83,569
Yellow-poplar	19,425	--	--	--	19,425
Black walnut	26,773	--	--	200	26,573
Black cherry	313,738	49,645	53,658	94,087	116,348
Butternut	3,662	--	--	278	3,384
Elm	278,253	41,158	148,178	30,117	58,800
Paper birch	813,842	253,926	282,834	256,960	20,122
Other hardwoods	87,949	239	177	10,705	76,828
Total	13,748,201	2,286,460	4,056,362	5,117,615	2,287,764
All species	19,103,800	4,034,744	5,785,031	6,824,666	2,459,359

Table 13.--Net volume of sawtimber on commercial forest land by species group and Forest Survey Unit, Michigan, 1980

(In thousand board feet)[1/]

Species group	All Units	Forest Survey Unit: Eastern Upper Peninsula	Western Upper Peninsula	Northern Lower Peninsula	Southern Lower Peninsula
SOFTWOODS					
White pine	2,606,707	736,589	780,033	811,402	278,683
Red pine	1,890,783	447,746	279,874	1,053,736	109,427
Jack pine	1,300,487	309,368	276,692	684,828	29,599
White spruce	1,395,518	527,783	745,345	121,852	538
Black spruce	364,731	169,698	153,343	41,690	--
Balsam fir	1,086,763	323,226	610,899	151,930	708
Hemlock	2,389,793	661,391	1,444,202	252,871	31,329
Tamarack	191,493	66,942	61,261	56,260	7,030
Northern white-cedar	2,648,562	996,280	994,377	653,206	4,699
Other softwoods	70,682	1,602	589	11,647	56,844
Total	13,945,519	4,240,625	5,346,615	3,839,422	518,857
HARDWOODS					
Select white oaks	1,791,072	637	3,693	572,193	1,214,549
Select red oaks	3,903,389	65,731	298,531	2,159,690	1,379,437
Other red oaks	931,164	--	--	488,102	443,062
Hickory	331,572	--	--	5,588	325,984
Yellow birch	1,516,165	367,659	1,049,376	77,578	21,552
Hard maple	6,997,862	1,366,336	4,009,886	1,188,575	433,065
Soft maple	4,813,225	947,043	1,168,709	1,450,072	1,247,401
Beech	1,240,413	653,154	821	389,470	196,968
Ash	1,469,167	88,096	278,324	487,434	615,313
Balsam poplar	811,808	278,417	153,205	353,766	26,420
Cottonwood	291,306	1,936	371	42,830	246,169
Bigtooth aspen	1,842,998	112,159	242,428	1,339,410	149,001
Quaking aspen	3,460,406	638,290	1,360,347	1,366,066	95,703
Basswood	1,772,955	132,115	505,144	834,836	300,860
Yellow-poplar	87,069	--	--	--	87,069
Black walnut	84,707	--	--	--	84,707
Black cherry	593,837	91,220	55,406	172,403	274,808
Butternut	8,952	--	--	1,427	7,525
Elm	632,956	124,011	396,325	44,130	68,490
Paper birch	910,295	287,113	376,599	233,758	12,825
Other hardwoods	232,299	665	432	35,432	195,770
Total	33,723,617	5,154,582	9,899,597	11,242,760	7,426,678
All species	47,669,136	9,395,207	15,246,212	15,082,182	7,945,535

[1/] International 1/4-inch rule.

Table 14.--Net volume of growing stock on commercial forest land by species group and diameter class, Michigan, 1980

(In thousand cubic feet)

Species group	All classes	Diameter class (inches at breast height) 5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS													
White pine	543,535	23,688	38,480	49,740	51,529	75,803	66,833	61,706	50,733	44,569	63,782	16,197	475
Red pine	713,841	181,571	183,334	107,177	76,587	49,565	50,314	33,060	18,617	9,163	4,453	--	--
Jack pine	628,201	161,131	214,979	151,117	60,108	26,655	9,580	4,158	365	108	--	--	--
White spruce	396,698	51,265	67,840	89,604	68,753	54,405	32,559	18,942	6,688	3,722	2,920	--	--
Black spruce	343,499	162,554	106,254	44,180	15,775	5,595	3,199	762	5,180	--	--	--	--
Balsam fir	780,816	298,257	244,577	141,120	66,420	20,806	7,680	1,212	--	--	744	--	--
Hemlock	486,735	21,975	40,360	52,226	70,607	81,244	73,999	48,787	37,871	25,444	29,831	4,305	86
Tamarack	108,188	39,079	28,198	23,517	9,761	4,366	2,601	278	68	320	--	--	--
Northern white-cedar	1,297,942	393,828	346,857	232,620	144,362	84,872	47,112	21,617	11,973	7,157	6,408	1,136	--
Other softwoods	56,144	26,612	15,677	8,159	2,906	2,671	--	--	119	--	--	--	--
Total	5,355,599	1,359,960	1,286,556	899,460	566,808	405,982	293,877	190,522	131,614	90,483	108,138	21,638	561
HARDWOODS													
Select white oaks	561,599	62,124	86,854	87,544	77,328	58,380	57,757	40,455	29,584	17,452	27,804	13,914	2,403
Select red oaks	1,166,227	85,143	156,629	204,332	193,432	158,695	128,701	93,810	56,135	36,308	43,073	9,382	587
Other red oaks	291,036	26,836	40,386	52,047	51,101	37,246	28,913	25,737	9,748	6,985	9,652	2,385	--
Hickory	105,470	8,016	17,430	23,692	20,032	13,929	8,566	6,489	2,885	2,076	1,495	396	464
Yellow birch	466,546	52,657	67,576	68,527	57,294	63,422	52,118	38,612	22,929	16,500	18,547	5,300	3,064
Hard maple	2,748,772	502,732	530,603	459,286	335,868	281,621	243,518	165,461	99,710	48,778	63,805	15,903	1,487
Soft maple	2,252,752	429,805	493,406	414,115	301,108	221,054	144,524	91,909	59,153	32,010	44,491	17,474	3,703
Beech	337,921	35,378	37,685	43,271	42,456	52,269	45,644	34,208	21,231	12,516	11,365	1,898	--
Ash	677,231	146,630	131,018	125,333	96,186	66,853	46,582	26,584	15,316	8,198	11,147	3,152	232
Balsam poplar	240,668	20,722	35,160	37,959	40,179	38,331	29,023	16,944	11,594	6,524	2,884	1,348	--
Cottonwood	70,608	3,150	4,451	9,201	6,817	7,238	10,180	3,908	5,386	5,164	8,050	5,204	1,859
Bigtooth aspen	903,436	114,004	200,945	239,113	182,635	95,937	39,974	20,035	6,173	2,490	2,130	--	--
Quaking aspen	1,713,956	263,758	397,878	408,671	321,016	177,489	88,523	36,677	15,041	3,491	947	465	--
Basswood	668,337	73,299	125,989	151,210	117,253	81,734	52,619	32,174	14,888	7,831	8,270	1,428	1,642
Yellow-poplar	19,425	1,064	1,337	1,295	1,950	2,982	3,209	879	4,017	1,757	935	--	--
Black walnut	26,773	2,491	2,776	4,892	3,279	4,380	4,422	1,633	1,052	1,229	619	--	--
Black cherry	313,738	51,386	79,507	63,079	48,932	35,993	16,210	9,257	5,252	3,198	709	215	--
Butternut	3,662	639	575	649	495	954	180	170	--	--	--	--	--
Elm	278,253	57,035	58,511	46,050	40,044	30,672	18,169	11,789	8,119	2,796	3,176	1,775	117
Paper birch	813,842	206,120	247,693	184,590	101,380	43,728	21,071	5,602	1,875	972	811	--	--
Other hardwoods	87,949	16,050	12,817	14,080	7,763	8,950	6,381	1,889	4,864	2,861	7,472	4,048	774
Total	13,748,201	2,159,039	2,729,226	2,638,936	2,046,548	1,481,857	1,046,284	664,222	394,952	219,136	267,382	84,287	16,332
All species	19,103,800	3,518,999	4,015,782	3,538,396	2,613,356	1,887,839	1,340,161	854,744	526,566	309,619	375,520	105,925	16,893

Table 15.--Net volume of sawtimber on commercial forest land by species group and diameter class, Michigan, 1980

(In thousand board feet)[1/]

Species group	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS											
White pine	2,606,707	245,752	262,912	395,792	359,203	335,441	282,865	253,983	369,197	98,512	3,050
Red pine	1,890,783	555,167	419,677	275,652	280,599	184,247	102,183	48,866	24,392	--	--
Jack pine	1,300,487	774,513	314,310	138,633	50,032	20,615	1,812	572	--	--	--
White spruce	1,395,518	441,510	340,707	273,359	167,499	99,231	35,886	20,752	16,574	--	--
Black spruce	364,731	201,770	78,275	29,730	18,267	4,423	32,266	--	--	--	--
Balsam fir	1,086,763	620,775	312,726	102,916	39,523	6,395	--	--	4,428	--	--
Hemlock	2,389,793	282,309	390,235	452,204	421,267	278,507	216,938	147,581	175,778	24,463	511
Tamarack	191,493	102,837	48,218	22,607	14,167	1,212	265	2,187	--	--	--
Northern white-cedar	2,648,562	1,083,495	683,362	406,348	231,607	107,404	60,092	36,485	33,700	6,069	--
Other softwoods	70,682	41,607	14,457	14,080	--	--	538	--	--	--	--
Total	13,945,519	4,349,735	2,864,879	2,111,321	1,582,164	1,037,475	732,845	510,426	624,069	129,044	3,561
HARDWOODS											
Select white oaks	1,791,072	--	403,874	320,643	322,193	230,985	171,607	99,935	155,806	75,595	10,434
Select red oaks	3,903,389	--	958,842	849,054	719,012	537,457	329,388	211,944	244,847	50,034	2,811
Other red oaks	931,164	--	250,367	202,759	164,531	148,723	54,996	40,504	55,784	13,500	--
Hickory	331,572	--	115,043	84,589	51,982	39,287	16,621	11,831	8,099	2,273	1,847
Yellow birch	1,516,165	--	309,403	350,194	292,626	218,088	124,685	91,907	94,375	23,210	11,677
Hard maple	6,997,862	--	1,719,165	1,574,287	1,409,004	979,582	587,289	281,607	353,767	84,781	8,380
Soft maple	4,813,225	--	1,500,241	1,188,124	792,436	506,791	320,791	166,163	229,346	90,080	19,253
Beech	1,240,413	--	226,904	296,528	267,600	199,702	119,532	67,196	54,859	8,092	--
Ash	1,469,167	--	494,039	359,718	257,378	148,361	85,018	45,869	61,564	16,261	959
Balsam poplar	811,808	--	237,986	215,608	156,487	89,373	59,036	33,545	13,602	6,171	--
Cottonwood	291,306	--	38,032	41,397	55,732	22,799	30,973	25,070	40,127	27,388	9,788
Bigtooth aspen	1,842,998	--	920,583	522,590	225,570	115,350	34,410	13,739	10,756	--	--
Quaking aspen	3,460,406	--	1,671,421	974,041	496,973	206,150	85,765	18,861	4,981	2,214	--
Basswood	1,772,955	--	629,342	460,074	306,248	185,936	86,081	45,558	45,738	7,525	6,453
Yellow-poplar	87,069	--	10,157	15,831	17,872	4,943	22,957	10,654	4,655	--	--
Black walnut	84,707	--	16,626	23,805	22,528	8,194	4,722	6,275	2,557	--	--
Black cherry	593,837	--	240,419	189,808	83,187	42,815	22,223	12,788	2,095	502	--
Butternut	8,952	--	2,357	4,771	1,002	822	--	--	--	--	--
Elm	632,956	--	226,609	170,183	96,668	60,434	41,216	13,209	15,634	8,436	567
Paper birch	910,295	--	527,494	227,962	106,895	28,965	9,769	5,114	4,096	--	--
Other hardwoods	232,299	--	39,871	45,846	30,617	10,021	25,590	14,366	39,893	21,729	4,366
Total	33,723,617	--	10,538,775	8,117,812	5,876,541	3,784,778	2,232,669	1,216,135	1,442,581	437,791	76,535
All species	47,669,136	4,349,735	13,403,654	10,229,133	7,458,705	4,822,253	2,965,514	1,726,561	2,066,650	566,835	80,096

[1/] International 1/4-inch rule.

Table 16.--Net volume of growing stock on commercial forest land by species group and forest type, Michigan, 1980

(In thousand cubic feet)

Species group	All types	Forest type						
		Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar
SOFTWOODS								
White pine	543,535	11,902	31,015	172,551	28,925	6,342	17,407	37,742
Red pine	713,841	58,444	499,773	25,852	4,596	1,824	6,365	1,844
Jack pine	628,201	461,954	61,819	4,609	697	976	17,877	--
White spruce	396,698	537	3,428	9,528	110,501	49,421	5,492	38,159
Black spruce	343,499	8,060	2,849	6,124	31,832	2,733	174,509	74,651
Balsam fir	780,816	1,100	4,497	8,198	210,614	11,437	23,845	107,103
Hemlock	486,735	--	1,337	2,064	8,873	174	2,310	13,608
Tamarack	108,188	211	292	590	5,896	497	13,815	34,340
Northern white-cedar	1,297,942	136	947	3,004	61,126	11,408	31,317	840,496
Other softwoods	56,144	--	3,185	5,557	81	1,678	77	1,029
Total	5,355,599	542,344	609,142	238,077	463,141	86,490	293,014	1,148,972
HARDWOODS								
Select white oaks	561,599	2,791	8,103	4,410	--	--	--	--
Select red oaks	1,166,227	31,761	15,069	8,034	498	--	--	--
Other red oaks	291,036	13,037	10,964	--	--	--	--	--
Hickory	105,470	306	--	--	--	--	--	--
Yellow birch	466,546	--	--	468	12,406	310	1,482	15,136
Hard maple	2,748,772	145	1,640	3,121	5,869	1,264	813	5,019
Soft maple	2,252,752	4,600	10,239	10,205	40,412	2,746	4,680	44,527
Beech	337,921	--	515	312	216	108	--	--
Ash	677,231	--	278	--	4,217	--	1,787	26,146
Balsam poplar	240,668	--	90	390	11,340	2,743	1,190	27,339
Cottonwood	70,608	--	--	--	--	--	--	--
Bigtooth aspen	903,436	3,539	11,685	3,447	2,162	215	1,995	5,280
Quaking aspen	1,713,956	14,681	13,378	13,659	58,582	16,604	24,248	28,504
Basswood	668,337	464	712	206	318	--	--	1,753
Yellow-poplar	19,425	--	344	--	--	--	--	--
Black walnut	26,773	--	200	--	--	--	--	--
Black cherry	313,738	365	2,304	971	3,753	1,347	316	705
Butternut	3,662	--	--	--	--	--	--	350
Elm	278,253	144	--	191	5,033	432	--	2,084
Paper birch	813,842	1,032	4,700	16,916	47,127	3,205	13,074	93,644
Other hardwoods	87,949	183	--	--	--	--	--	336
Total	13,748,201	73,048	80,221	62,330	191,933	28,974	49,585	250,823
All species	19,103,800	615,392	689,363	300,407	655,074	115,464	342,599	1,399,795

(Table 16 continued on next page)

(Table 16 continued)

Species group	Forest type							
	Tamarack	Oak hickory	Elm-ash-soft maple	Maple-birch	Aspen	Paper birch	Exotic	Non-stocked
SOFTWOODS								
White pine	1,283	29,318	16,928	125,352	55,255	7,570	1,779	166
Red pine	223	30,862	2,656	21,444	50,264	3,906	5,395	393
Jack pine	570	41,612	--	10,866	22,781	3,025	837	578
White spruce	53	700	14,481	84,845	66,443	13,078	--	32
Black spruce	5,512	390	7,721	11,631	14,401	2,969	--	117
Balsam fir	2,107	1,909	37,846	188,078	158,522	25,226	--	334
Hemlock	--	1,228	20,506	423,029	9,741	3,865	--	--
Tamarack	34,282	--	6,843	2,489	6,315	2,383	--	235
Northern white-cedar	6,026	402	73,348	133,030	107,608	28,822	109	163
Other softwoods	--	1,886	389	9,644	256	--	32,362	--
Total	50,056	108,307	180,718	1,010,408	491,586	90,844	40,482	2,018
HARDWOODS								
Select white oaks	--	434,450	24,234	65,885	20,927	799	--	--
Select red oaks	--	744,332	12,490	221,794	123,867	7,415	809	158
Other red oaks	--	241,835	2,919	15,058	6,912	--	311	--
Hickory	--	61,941	2,953	39,599	500	171	--	--
Yellow birch	--	966	29,696	396,494	6,788	2,674	126	--
Hard maple	--	15,044	17,493	2,626,787	57,024	14,110	443	--
Soft maple	88	118,172	472,280	1,255,908	247,798	40,254	415	428
Beech	--	3,634	3,220	322,627	6,738	551	--	--
Ash	248	29,692	223,683	340,804	41,845	8,164	92	275
Balsam poplar	894	638	16,496	17,936	155,421	5,594	415	182
Cottonwood	--	5,979	33,311	21,019	10,299	--	--	--
Bigtooth aspen	--	116,647	8,105	160,182	577,838	12,307	--	34
Quaking aspen	1,434	25,033	57,237	331,814	1,089,695	37,583	1,192	312
Basswood	--	9,220	25,710	602,093	22,638	4,786	437	--
Yellow-poplar	--	2,537	1,945	14,599	--	--	--	--
Black walnut	--	18,533	2,782	5,258	--	--	--	--
Black cherry	--	46,643	18,029	214,027	23,694	645	627	312
Butternut	--	1,205	776	1,331	--	--	--	--
Elm	--	4,593	51,128	192,580	20,668	1,224	113	63
Paper birch	1,338	15,538	36,693	158,826	205,306	216,225	--	218
Other hardwoods	--	9,164	35,937	39,831	2,324	174	--	--
Total	4,002	1,905,796	1,077,117	7,044,452	2,620,282	352,676	4,980	1,982
All species	54,058	2,014,103	1,257,835	8,054,860	3,111,868	443,520	45,462	4,000

Table 17.--Net volume of sawtimber on commercial forest land by species group and forest type, Michigan, 1980

(In thousand board feet)[1/]

Species group	All types	Forest type						
		Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar
SOFTWOODS								
White pine	2,606,707	56,083	128,503	828,705	148,720	29,388	87,338	207,039
Red pine	1,890,783	207,759	1,092,156	118,307	22,596	8,101	26,939	9,905
Jack pine	1,300,487	925,465	114,400	14,144	1,473	3,177	46,222	--
White spruce	1,395,518	2,243	5,145	32,189	400,011	140,131	21,352	136,863
Black spruce	364,731	4,124	3,427	8,844	55,703	3,462	129,699	93,800
Balsam fir	1,086,763	4,368	6,895	11,756	284,346	21,129	37,322	103,633
Hemlock	2,389,793	--	3,740	10,656	42,679	1,049	11,251	69,880
Tamarack	191,493	--	839	2,371	15,250	1,171	13,299	49,893
Northern white-cedar	2,648,562	--	1,028	4,989	168,235	24,352	86,486	1,526,267
Other softwoods	70,682	--	4,129	9,545	--	1,449	--	
Total	13,945,519	1,200,042	1,360,262	1,041,506	1,139,013	233,409	459,908	2,197,280
HARDWOODS								
Select white oaks	1,791,072	7,720	28,425	19,367	--	--	--	--
Select red oaks	3,903,389	75,759	60,740	16,939	--	--	--	--
Other red oaks	931,164	29,528	32,664	--	--	--	--	--
Hickory	331,572	1,337	--	--	--	--	--	--
Yellow birch	1,516,165	--	--	1,076	48,015	674	5,897	49,338
Hard maple	6,997,862	--	1,786	5,602	15,336	1,491	1,943	11,483
Soft maple	4,813,225	3,610	12,385	11,269	70,336	--	3,801	75,481
Beech	1,240,413	--	2,857	--	--	634	--	--
Ash	1,469,167	--	686	--	3,813	--	786	16,933
Balsam poplar	811,808	--	511	681	33,597	9,770	1,319	85,881
Cottonwood	291,306	--	--	--	--	--	--	--
Bigtooth aspen	1,842,998	3,914	12,941	6,801	9,487	1,235	1,252	19,573
Quaking aspen	3,460,406	4,399	4,879	18,101	102,656	19,864	18,856	84,063
Basswood	1,772,955	1,212	2,317	--	1,127	--	--	4,880
Yellow-poplar	87,069	--	--	--	--	--	--	--
Black walnut	84,707	--	--	--	--	--	--	--
Black cherry	593,837	--	2,261	1,847	2,127	3,160	--	456
Butternut	8,952	--	--	--	--	--	--	1,824
Elm	632,956	--	--	--	7,609	1,298	--	4,713
Paper birch	910,295	667	5,202	27,123	57,417	1,846	16,312	106,726
Other hardwoods	232,299	--	--	--	--	--	--	878
Total	33,723,617	128,146	167,654	108,806	351,520	39,972	50,166	462,229
All species	47,669,136	1,328,188	1,527,916	1,150,312	1,490,533	273,381	510,074	2,659,509

(Table 17 continued on next page)

[1/] International 1/4-inch rule.

(Table 17 continued)

Species group	Forest type							
	Tamarack	Oak hickory	Elm-ash-soft maple	Maple-birch	Aspen	Paper birch	Exotic	Non-stocked
SOFTWOODS								
White pine	5,626	123,802	88,393	598,885	262,124	34,777	6,709	615
Red pine	1,175	92,455	10,881	71,883	205,124	18,773	3,568	1,161
Jack pine	2,506	95,371	--	25,135	53,470	13,711	4,183	1,230
White spruce	--	1,647	58,452	335,397	223,168	38,762	--	158
Black spruce	6,362	696	15,132	26,732	14,227	2,006	--	517
Balsam fir	1,503	2,132	45,254	334,135	210,542	23,129	--	619
Hemlock	--	4,655	90,970	2,108,068	33,196	13,649	--	--
Tamarack	57,353	--	15,435	12,574	19,002	3,190	--	1,116
Northern white-cedar	12,403	1,324	170,533	428,636	178,311	45,597	--	401
Other softwoods	--	9,284	--	10,708	538	--	35,029	--
Total	86,928	331,366	495,050	3,952,153	1,199,702	193,594	49,489	5,817
HARDWOODS								
Select white oaks	--	1,296,511	101,861	262,546	71,666	2,976	--	--
Select red oaks	--	2,391,024	52,234	901,657	382,868	20,282	972	914
Other red oaks	--	771,731	13,136	63,396	20,709	--	--	--
Hickory	--	194,063	7,907	125,213	2,102	950	--	--
Yellow birch	--	1,619	87,716	1,309,495	8,830	2,746	759	--
Hard maple	--	29,395	43,280	6,803,486	58,648	23,945	1,467	--
Soft maple	--	174,085	1,425,181	2,757,752	244,043	32,127	1,556	1,599
Beech	--	8,305	9,614	1,213,367	5,198	438	--	--
Ash	--	81,152	471,798	840,298	50,703	2,522	476	--
Balsam poplar	3,193	2,592	64,163	67,138	524,253	17,967	--	743
Cottonwood	--	30,343	122,000	93,323	45,640	--	--	--
Bigtooth aspen	--	194,329	20,154	436,493	1,108,032	28,787	--	--
Quaking aspen	2,090	23,213	135,407	874,387	2,089,131	83,360	--	--
Basswood	--	20,331	82,824	1,602,968	43,577	13,719	--	--
Yellow-poplar	--	12,171	11,117	63,781	--	--	--	--
Black walnut	--	63,602	7,117	13,988	--	--	--	--
Black cherry	--	99,467	43,926	408,161	30,675	--	1,757	--
Butternut	--	1,857	2,605	2,666	--	--	--	--
Elm	--	3,735	88,410	499,350	25,705	2,136	--	--
Paper birch	773	17,695	55,706	274,455	172,374	173,999	--	--
Other hardwoods	--	13,751	120,775	92,655	3,357	883	--	--
Total	6,056	5,430,971	2,966,931	18,706,575	4,887,511	406,837	6,987	3,256
All species	92,984	5,762,337	3,461,981	22,658,728	6,087,213	600,431	56,476	9,073

Table 18.--Net volume of growing stock on commercial forest land by species group and ownership class, Michigan, 1980

(In thousand cubic feet)

Species group	All owners	Ownership class									
		National Forest	Bureau of Land Mgmt.	Misc. federal	Indian	State	County & municipal	Forest industry	Farmer	Misc. priv.-corp.	Misc. priv.-indiv.
SOFTWOODS											
White pine	543,535	71,803	--	420	--	143,919	3,076	62,007	51,182	73,680	137,448
Red pine	713,841	299,569	--	1,159	--	197,218	16,476	15,912	50,162	38,253	95,092
Jack pine	628,201	231,742	--	5,290	--	235,355	9,235	12,412	23,397	19,591	91,179
White spruce	396,698	99,104	--	844	336	68,625	1,989	72,882	31,569	52,630	68,719
Black spruce	343,499	87,732	--	94	149	101,819	3,182	56,850	16,454	25,289	51,930
Balsam fir	780,816	132,536	--	2,774	207	158,226	5,748	152,382	78,923	79,301	170,719
Hemlock	486,735	74,200	--	184	2,926	54,960	5,958	160,578	49,088	44,736	94,105
Tamarack	108,188	6,892	--	--	118	36,706	776	18,103	15,988	5,679	23,926
Northern white-cedar	1,297,942	112,202	--	242	509	334,415	10,355	230,070	197,862	133,630	278,657
Other softwoods	56,144	519	--	--	--	489	--	--	19,309	5,723	30,104
Total	5,355,599	1,116,299	--	11,007	4,245	1,331,732	56,795	781,196	533,934	478,512	1,041,879
HARDWOODS											
Select white oaks	561,599	65,370	--	746	--	79,858	3,710	1,515	159,411	37,002	213,987
Select red oaks	1,166,227	46,232	--	259	258	264,995	11,614	29,257	240,128	123,030	450,454
Other red oaks	291,036	127,334	--	414	--	24,074	3,457	1,487	37,170	9,580	87,520
Hickory	105,470	--	--	--	--	3,127	1,268	--	65,033	1,320	34,722
Yellow birch	466,546	83,450	--	1,348	3,879	48,908	5,050	148,567	33,869	56,980	84,495
Hard maple	2,748,772	384,544	--	379	9,827	307,853	26,335	615,682	500,156	287,078	616,918
Soft maple	2,252,752	269,855	--	1,506	5,924	379,071	19,259	305,003	403,680	235,554	632,900
Beech	337,921	43,943	--	--	--	35,432	2,084	75,704	78,217	21,466	81,075
Ash	677,231	52,200	--	95	682	76,048	10,141	54,736	213,810	48,155	221,364
Balsam poplar	240,668	7,358	--	--	237	51,545	118	25,682	60,068	18,241	77,419
Cottonwood	70,608	--	--	--	--	1,790	--	1,266	40,493	5,060	21,999
Bigtooth aspen	903,436	87,344	--	--	3,801	211,848	11,336	22,935	151,406	77,617	337,149
Quaking aspen	1,713,956	280,640	--	3,589	5,177	340,094	17,971	144,165	259,747	167,355	495,218
Basswood	668,337	68,435	--	--	624	115,920	5,355	52,784	169,803	58,674	196,742
Yellow-poplar	19,425	--	--	--	--	--	--	--	9,225	342	9,858
Black walnut	26,773	--	--	--	--	--	--	--	14,379	325	12,069
Black cherry	313,738	43,551	--	--	85	43,916	2,877	28,817	95,817	18,062	80,613
Butternut	3,662	--	--	--	--	--	471	--	1,903	325	963
Elm	278,253	46,227	--	156	842	32,190	4,265	37,993	61,883	23,933	70,764
Paper birch	813,842	99,472	--	1,864	526	192,338	2,774	100,739	116,873	85,376	213,880
Other hardwoods	87,949	--	--	--	--	2,536	1,813	348	32,658	6,793	43,801
Total	13,748,201	1,705,955	--	10,356	31,862	2,211,543	129,898	1,646,680	2,745,729	1,282,268	3,983,910
All species	19,103,800	2,822,254	--	21,363	36,107	3,543,275	186,693	2,427,876	3,279,663	1,760,780	5,025,789

Table 19.--Net volume of sawtimber on commercial forest land by species group and ownership class, Michigan, 1980

(In thousand board feet)[1/]

Species group	All owners	Ownership class									
		National Forest	Bureau of Land Mgmt.	Misc. federal	Indian	State	County & municipal	Forest industry	Farmer	Misc. priv.-corp.	Misc. priv.-indiv.
SOFTWOODS											
White pine	2,606,707	372,730	--	--	--	694,363	12,466	319,199	235,687	370,732	601,530
Red pine	1,890,783	572,681	--	5,931	--	693,096	51,655	67,808	95,694	115,959	287,959
Jack pine	1,300,487	411,769	--	11,800	--	501,957	19,055	27,381	59,418	63,338	205,769
White spruce	1,395,518	374,814	--	3,428	709	241,522	6,103	253,636	107,513	193,199	214,594
Black spruce	364,731	86,413	--	--	--	97,025	5,469	62,025	16,414	36,868	60,517
Balsam fir	1,086,763	190,226	--	8,155	428	218,627	8,988	203,815	89,393	124,874	242,257
Hemlock	2,389,793	384,936	--	1,062	15,318	261,926	28,492	834,703	210,855	222,938	429,563
Tamarack	191,493	9,045	--	--	--	55,670	1,460	33,953	31,210	15,350	44,805
Northern white-cedar	2,648,562	212,903	--	409	1,535	621,502	31,029	590,033	291,924	359,497	539,730
Other softwoods	70,682	1,800	--	--	--	--	--	--	18,400	11,143	39,339
Total	13,945,519	2,617,317	--	30,785	17,990	3,385,688	164,717	2,392,553	1,156,508	1,513,898	2,666,063
HARDWOODS											
Select white oaks	1,791,072	134,945	--	--	--	217,558	4,753	4,086	668,357	122,079	639,294
Select red oaks	3,903,389	138,126	--	886	1,410	737,124	31,612	96,353	978,841	407,642	1,511,395
Other red oaks	931,164	321,540	--	--	--	82,067	1,104	6,670	147,488	35,527	336,768
Hickory	331,572	--	--	--	--	5,920	4,603	--	204,827	3,962	112,260
Yellow birch	1,516,165	260,600	--	4,587	12,291	157,684	14,568	556,720	89,341	172,867	247,507
Hard maple	6,997,862	1,058,534	--	1,527	17,452	601,569	51,544	2,061,326	1,162,195	775,149	1,268,566
Soft maple	4,813,225	431,522	--	3,995	5,783	670,655	42,721	717,415	1,027,008	505,925	1,408,201
Beech	1,240,413	146,324	--	--	--	115,705	7,034	313,414	291,195	72,481	294,260
Ash	1,469,167	79,123	--	--	1,855	142,117	23,057	132,497	489,237	115,067	486,214
Balsam poplar	811,808	37,265	--	--	1,295	163,947	--	80,472	192,608	70,925	265,296
Cottonwood	291,306	--	--	--	--	9,101	--	6,805	171,798	15,811	87,791
Bigtooth aspen	1,842,998	122,224	--	--	10,541	406,538	33,178	55,701	359,401	161,933	693,482
Quaking aspen	3,460,406	528,501	--	--	8,265	703,293	30,176	279,609	524,340	381,148	1,005,074
Basswood	1,772,955	139,470	--	--	3,436	268,331	6,949	149,881	476,167	168,729	559,992
Yellow-poplar	87,069	--	--	--	--	--	--	--	44,619	1,480	40,970
Black walnut	84,707	--	--	--	--	--	--	--	44,944	--	39,763
Black cherry	593,837	74,218	--	--	--	81,652	2,053	34,957	220,347	28,097	152,513
Butternut	8,952	--	--	--	--	--	2,605	--	3,251	1,692	1,404
Elm	632,956	115,651	--	--	3,034	74,179	9,797	109,319	111,078	64,669	145,229
Paper birch	910,295	98,211	--	2,331	--	208,713	3,358	140,619	123,149	107,438	226,476
Other hardwoods	232,299	--	--	--	--	1,761	6,999	1,755	92,571	22,797	106,416
Total	33,723,617	3,686,254	--	13,326	65,362	4,647,914	276,111	4,747,599	7,422,762	3,235,418	9,628,871
All species	47,669,136	6,303,571	--	44,111	83,352	8,033,602	440,828	7,140,152	8,579,270	4,749,316	12,294,934

[1/] International 1/4-inch rule.

Table 20.--Net volume of growing stock on commercial forest land by forest type and stand-age class, Michigan, 1980

(In thousand cubic feet)

Forest type	All classes	Stand-age class (years)								
		1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90
Jack pine	615,392	18,064	31,194	39,905	118,623	196,292	103,018	46,685	43,209	11,921
Red pine	689,363	4,793	41,675	211,338	182,790	96,315	11,932	38,590	23,998	25,121
White pine	300,407	1,409	7,174	9,903	3,519	23,171	17,532	64,425	40,821	41,210
Balsam fir	655,074	22,275	27,869	21,273	65,961	166,790	103,224	75,671	56,369	33,749
White spruce	115,464	2,776	6,380	550	20,974	15,636	16,045	10,097	7,163	14,429
Black spruce	342,599	20,336	21,784	51,867	60,672	39,775	46,405	34,615	20,929	3,067
Northern white-cedar	1,399,795	9,314	20,087	39,295	41,300	59,906	142,568	184,924	169,968	188,128
Tamarack	54,058	3,761	6,488	5,686	1,777	3,249	11,564	7,516	4,094	1,686
Oak-hickory	2,014,103	57,066	49,435	14,251	99,431	228,999	349,390	262,105	264,484	207,987
Elm-ash-soft maple	1,257,835	53,302	55,065	50,454	111,034	120,713	143,501	118,266	130,197	140,663
Maple-birch	8,054,860	183,915	180,837	166,791	446,673	1,270,338	1,263,149	770,979	599,598	772,680
Aspen	3,111,868	202,827	203,564	86,556	402,194	626,643	637,859	368,606	260,640	130,945
Paper birch	443,520	13,173	10,805	5,020	29,841	53,730	144,223	100,170	39,853	12,418
Exotic	45,462	474	5,178	17,451	10,676	2,130	9,553	--	--	--
Nonstocked	4,000	674	614	310	396	702	806	--	--	498
All types	19,103,800	594,159	668,149	720,650	1,595,861	2,904,389	3,000,769	2,082,649	1,661,323	1,584,502

91-100	101-120	121-140	141+
3,936	1,667	878	--
17,043	33,823	1,945	--
36,042	20,581	24,198	10,422
25,265	34,626	15,696	6,306
--	17,297	--	4,117
8,474	17,834	10,661	6,180
137,008	206,687	104,044	96,566
4,238	2,025	--	1,974
127,770	275,994	68,391	8,800
81,289	161,304	65,493	26,554
697,995	1,034,839	473,650	193,416
92,231	86,108	13,695	--
18,144	5,355	8,160	2,628
--	--	--	--
--	--	--	--
1,249,435	1,898,140	786,811	356,963

Table 21.--Net volume of sawtimber on commercial forest land by forest type and stand-age class, Michigan, 1980

(In thousand board feet)[1/]

Forest type	All classes	Stand-age class (years)									
		1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
Jack pine	1,328,188	34,476	58,976	41,761	246,450	346,649	259,384	140,922	137,978	37,069	16,750
Red pine	1,527,916	4,758	63,557	211,694	367,983	243,041	51,626	147,657	105,097	97,735	80,896
White pine	1,150,312	3,831	32,490	15,759	9,729	58,223	60,421	236,866	160,103	172,774	159,280
Balsam fir	1,490,533	46,060	45,458	34,011	103,618	412,748	187,869	151,232	145,324	99,527	80,621
White spruce	273,381	8,676	15,436	--	13,030	40,915	33,184	29,084	18,234	44,118	--
Black spruce	510,074	24,688	34,696	96,328	48,126	52,490	49,147	48,910	20,055	--	27,647
Northern white-cedar	2,659,509	12,064	25,631	37,382	38,966	90,494	190,913	230,074	217,745	326,995	321,321
Tamarack	92,984	7,040	13,529	9,183	1,014	3,518	14,236	10,619	9,796	962	10,118
Oak-hickory	5,762,337	161,827	148,812	26,855	174,678	443,567	574,879	602,320	920,610	761,422	498,250
Elm-ash-soft maple	3,461,981	117,039	98,156	68,647	216,754	211,150	353,058	266,998	396,219	524,978	281,896
Maple-birch	22,658,728	422,925	440,118	322,354	804,328	2,257,431	2,448,171	2,019,740	1,841,658	2,666,833	2,566,641
Aspen	6,087,213	319,782	318,709	116,412	556,031	927,480	1,122,453	906,525	760,533	408,156	303,926
Paper birch	600,431	18,994	15,468	1,184	33,495	70,562	153,035	114,094	73,246	28,408	47,952
Exotic	56,476	--	4,393	4,947	8,015	660	38,461	--	--	--	--
Nonstocked	9,073	379	568	--	--	3,175	3,304	--	--	1,647	--
All types	47,669,136	1,182,539	1,315,997	986,517	2,622,217	5,162,103	5,540,141	4,905,041	4,806,598	5,170,624	4,395,298

[1/] International 1/4-inch rule.

101-120	121-140	141+
5,119	2,654	--
147,960	5,912	--
87,615	107,124	46,097
108,906	51,487	23,672
59,800	--	10,904
56,370	31,922	19,695
547,186	310,918	309,820
5,151	--	7,818
1,092,677	315,899	40,541
622,227	212,300	92,559
4,006,027	1,982,844	879,658
300,890	46,316	--
16,802	20,603	6,588
--	--	--
--	--	--
7,056,730	3,087,979	1,437,352

Table 22.--Net volume of growing stock on commercial forest land by forest type, stand-size class, and basal-area class, Michigan, 1980

(In thousand cubic feet)

Forest type and stand-size class	All classes	Basal-area class (square feet per acre)						
		0-10	11-20	21-30	31-40	41-50	51-60	61-70
Jack pine								
Sawtimber	155,794	--	--	1,956	4,528	14,559	17,817	30,078
Poletimber	400,160	--	1,041	5,903	7,504	38,393	21,069	38,172
Sapling & seedling	59,438	512	2,446	2,112	9,902	8,962	10,548	9,378
All stands	615,392	512	3,487	9,971	21,934	61,914	49,434	77,628
Red pine								
Sawtimber	221,394	--	619	--	4,439	5,782	1,378	10,741
Poletimber	428,759	--	--	--	1,238	4,638	6,594	9,923
Sapling & seedling	39,210	743	398	2,487	1,220	885	12,958	3,391
All stands	689,363	743	1,017	2,487	6,897	11,305	20,930	24,055
White pine								
Sawtimber	254,076	--	--	583	3,236	3,182	2,414	10,288
Poletimber	36,380	--	--	--	--	2,990	2,641	3,885
Sapling & seedling	9,951	283	765	1,587	846	1,453	1,914	3,103
All stands	300,407	283	765	2,170	4,082	7,625	6,969	17,276
Balsam fir								
Sawtimber	219,392	--	--	--	--	--	7,816	1,569
Poletimber	367,071	--	--	549	1,171	6,299	3,200	24,170
Sapling & seedling	68,611	129	2,110	2,498	8,326	9,964	6,245	12,061
All stands	655,074	129	2,110	3,047	9,497	16,263	17,261	37,800
White spruce								
Sawtimber	48,732	--	--	--	589	1,369	--	1,993
Poletimber	57,027	--	--	--	--	782	--	1,083
Sapling & seedling	9,705	--	643	502	1,228	1,236	1,004	1,522
All stands	115,464	--	643	502	1,817	3,387	1,004	4,598
Black spruce								
Sawtimber	17,665	--	--	--	--	--	1,330	--
Poletimber	251,865	174	--	710	28,464	4,343	9,853	10,205
Sapling & seedling	73,069	347	7,368	905	6,129	11,755	6,871	14,348
All stands	342,599	521	7,368	1,615	34,593	16,098	18,054	24,553
Northern white-cedar								
Sawtimber	491,375	--	--	--	2,403	1,679	3,030	6,397
Poletimber	821,372	--	--	--	1,709	944	2,625	7,854
Sapling & seedling	87,048	222	598	866	1,600	4,219	2,266	7,121
All stands	1,399,795	222	598	866	5,712	6,842	7,921	21,372

(Table 22 continued on next page)

(Table 22 continued)

Forest type and stand-size class	Basal-area class (square feet per acre)						
	71-80	81-90	91-100	101-120	121-150	151-180	181+
Jack pine							
Sawtimber	23,843	19,105	21,661	22,247	--	--	--
Poletimber	49,280	33,184	74,991	64,363	64,016	--	2,244
Sapling & seedling	8,037	2,500	--	--	5,041	--	--
All stands	81,160	54,789	96,652	86,610	69,057	--	2,244
Red pine							
Sawtimber	19,819	11,730	13,275	29,704	74,576	31,209	18,122
Poletimber	46,012	16,739	16,331	73,510	76,073	102,974	74,727
Sapling & seedling	10,329	4,608	--	1,199	992	--	--
All stands	76,160	33,077	29,606	104,413	151,641	134,183	92,849
White pine							
Sawtimber	27,331	17,584	27,675	60,640	17,189	83,954	--
Poletimber	5,647	4,000	1,772	11,060	4,385	--	--
Sapling & seedling	--	--	--	--	--	--	--
All stands	32,978	21,584	29,447	71,700	21,574	83,954	--
Balsam fir							
Sawtimber	--	15,663	26,153	73,608	71,436	7,810	15,337
Poletimber	32,514	16,472	37,663	86,169	72,738	62,047	24,079
Sapling & seedling	6,047	7,146	6,654	3,333	3,171	927	--
All stands	38,561	39,281	70,470	163,110	147,345	70,784	39,416
White spruce							
Sawtimber	1,806	1,939	3,766	11,359	10,665	6,256	8,990
Poletimber	3,448	5,787	7,474	5,050	25,679	4,565	3,159
Sapling & seedling	2,336	--	--	1,234	--	--	--
All stands	7,590	7,726	11,240	17,643	36,344	10,821	12,149
Black spruce							
Sawtimber	4,358	1,529	--	1,618	8,830	--	--
Poletimber	8,021	9,790	27,322	82,011	40,656	14,358	15,958
Sapling & seedling	6,759	3,537	7,591	5,259	2,200	--	--
All stands	19,138	14,856	34,913	88,888	51,686	14,358	15,958
Northern white-cedar							
Sawtimber	7,521	--	19,388	88,636	91,448	113,702	157,171
Poletimber	14,173	15,196	27,027	81,877	198,750	195,079	276,138
Sapling & seedling	9,743	4,978	5,925	15,603	20,395	12,535	977
All stands	31,437	20,174	52,340	186,116	310,593	321,316	434,286

(Table 22 continued on next page)

(Table 22 continued)

Forest type and stand-size class	All classes	Basal-area class (square feet per acre) 0-10	11-20	21-30	31-40	41-50	51-60	61-70
Tamarack								
Sawtimber	8,873	--	--	962	1,004	1,974	--	--
Poletimber	27,784	--	--	--	1,725	2,559	2,901	7,085
Sapling & seedling	17,401	181	1,040	1,951	4,095	218	1,232	1,747
All stands	54,058	181	1,040	2,913	6,824	4,751	4,133	8,832
Oak-hickory								
Sawtimber	990,954	255	--	3,057	7,086	22,062	55,141	73,719
Poletimber	912,736	--	277	--	2,158	31,305	72,848	94,836
Sapling & seedling	110,413	875	8,111	7,429	21,796	30,624	14,980	22,308
All stands	2,014,103	1,130	8,388	10,486	31,040	83,991	142,969	190,863
Elm-ash-soft maple								
Sawtimber	649,082	--	--	3,655	13,917	25,752	16,304	33,758
Poletimber	477,181	--	1,738	4,151	11,928	24,411	7,626	34,802
Sapling & seedling	131,572	914	3,472	7,446	21,812	23,684	19,723	18,861
All stands	1,257,835	914	5,210	15,252	47,657	73,847	43,653	87,421
Maple-birch								
Sawtimber	4,038,539	--	1,226	--	8,815	35,600	33,400	125,212
Poletimber	3,587,998	--	890	4,507	16,053	36,006	43,385	142,326
Sapling & seedling	428,323	2,773	13,634	14,166	50,047	58,997	51,865	84,437
All stands	8,054,860	2,773	15,750	18,673	74,915	130,603	128,650	351,975
Aspen								
Sawtimber	799,355	--	597	1,109	7,933	30,847	15,977	44,781
Poletimber	1,874,948	--	1,094	3,123	29,197	51,827	66,430	145,005
Sapling & seedling	437,565	4,028	20,671	37,106	54,103	89,727	57,248	67,622
All stands	3,111,868	4,028	22,362	41,338	91,233	172,401	139,655	257,408
Paper birch								
Sawtimber	53,516	--	--	--	765	--	1,236	3,305
Poletimber	365,324	--	--	--	1,007	7,074	11,587	13,742
Sapling & seedling	24,680	129	174	1,149	1,632	4,845	2,098	4,775
All stands	443,520	129	174	1,149	3,404	11,919	14,921	21,822
Exotic								
Sawtimber	8,226	--	--	--	--	--	--	--
Poletimber	30,094	--	--	--	--	--	1,736	--
Sapling & seedling	7,142	--	269	304	323	162	--	1,156
All stands	45,462	--	269	304	323	162	1,736	1,156
Nonstocked	4,000	900	2,580	97	27	--	--	312
All types								
Sawtimber	7,956,973	255	2,442	11,322	54,715	142,806	155,843	341,841
Poletimber	9,638,699	174	5,040	18,943	102,154	211,571	252,495	533,088
Sapling & seedling	1,504,128	11,136	61,699	80,508	183,059	246,731	188,952	251,830
Nonstocked	4,000	900	2,580	97	27	--	--	312
All stands	19,103,800	12,465	71,761	110,870	339,955	601,108	597,290	1,127,071

(Table 22 continued on next page)

(Table 22 continued)

Forest type and stand-size class	Basal-area class (square feet per acre)						
	71-80	81-90	91-100	101-120	121-150	151-180	181+
Tamarack							
Sawtimber	2,977	--	--	--	1,956	--	--
Poletimber	3,337	5,269	3,058	1,850	--	--	--
Sapling & seedling	3,205	2,358	384	--	990	--	--
All stands	9,519	7,627	3,442	1,850	2,946	--	--
Oak-hickory							
Sawtimber	107,495	114,464	107,768	223,481	226,662	49,764	--
Poletimber	123,920	108,713	133,035	189,381	110,137	26,246	19,880
Sapling & seedling	1,015	764	1,394	1,117	--	--	--
All stands	232,430	223,941	242,197	413,979	336,799	76,010	19,880
Elm-ash-soft maple							
Sawtimber	67,783	35,523	30,781	128,938	194,241	84,087	14,343
Poletimber	56,797	25,492	100,472	67,240	81,191	54,604	6,729
Sapling & seedling	16,348	1,680	10,441	4,906	2,285	--	--
All stands	140,928	62,695	141,694	201,084	277,717	138,691	21,072
Maple-birch							
Sawtimber	257,458	216,101	488,271	870,610	1,320,863	500,924	180,059
Poletimber	231,336	234,968	423,831	859,513	1,132,279	417,909	44,995
Sapling & seedling	49,294	43,348	26,651	26,333	6,778	--	--
All stands	538,088	494,417	938,753	1,756,456	2,459,920	918,833	225,054
Aspen							
Sawtimber	68,009	54,658	89,495	103,810	216,115	102,651	63,373
Poletimber	163,464	172,970	260,517	277,124	412,698	220,337	71,162
Sapling & seedling	36,454	14,191	28,544	15,936	11,935	--	--
All stands	267,927	241,819	378,556	396,870	640,748	322,988	134,535
Paper birch							
Sawtimber	--	1,886	4,938	13,638	22,597	--	5,151
Poletimber	24,483	11,539	56,423	58,522	135,897	36,749	8,301
Sapling & seedling	1,934	3,644	2,176	2,124	--	--	--
All stands	26,417	17,069	63,537	74,284	158,494	36,749	13,452
Exotic							
Sawtimber	--	--	--	8,226	--	--	--
Poletimber	1,327	1,665	5,610	9,426	5,447	4,883	--
Sapling & seedling	3,372	--	1,133	--	423	--	--
All stands	4,699	1,665	6,743	17,652	5,870	4,883	--
Nonstocked	84	--	--	--	--	--	--
All types							
Sawtimber	588,400	490,182	833,171	1,636,515	2,256,578	980,357	462,546
Poletimber	763,759	661,784	1,175,526	1,867,096	2,359,946	1,139,751	547,372
Sapling & seedling	154,873	88,754	90,893	77,044	54,210	13,462	977
Nonstocked	84	--	--	--	--	--	--
All stands	1,507,116	1,240,720	2,099,590	3,580,655	4,670,734	2,133,570	1,010,895

Table 23.--Net volume of sawtimber on commercial forest land by forest type, stand-size class, and basal-area class, Michigan, 1980

(In thousand board feet)[1/]

Forest type and stand-size class	All classes	Basal-area class (square feet per acre)						
		0-10	11-20	21-30	31-40	41-50	51-60	61-70
Jack pine								
Sawtimber	565,568	--	--	7,462	16,816	56,434	76,081	103,591
Poletimber	657,940	--	2,399	11,564	14,819	105,876	41,274	78,844
Sapling & seedling	104,680	1,436	6,397	2,302	17,307	17,389	17,132	29,289
All stands	1,328,188	1,436	8,796	21,328	48,942	179,699	134,487	211,724
Red pine								
Sawtimber	899,007	--	3,362	--	18,961	25,661	6,944	49,333
Poletimber	567,799	--	--	--	3,141	7,891	12,169	12,992
Sapling & seedling	61,110	3,862	836	4,257	--	803	26,198	12,755
All stands	1,527,916	3,862	4,198	4,257	22,102	34,355	45,311	75,080
White pine								
Sawtimber	1,044,586	--	--	2,609	12,531	12,212	9,674	46,156
Poletimber	64,319	--	--	--	--	8,808	4,870	5,307
Sapling & seedling	41,407	1,545	4,020	7,551	4,205	2,858	11,851	9,377
All stands	1,150,312	1,545	4,020	10,160	16,736	23,878	26,395	60,840
Balsam fir								
Sawtimber	722,252	--	--	--	--	--	27,042	6,462
Poletimber	650,408	--	--	584	2,084	7,905	5,788	43,449
Sapling & seedling	117,873	360	2,870	8,631	17,311	22,274	9,553	15,479
All stands	1,490,533	360	2,870	9,215	19,395	30,179	42,383	65,390
White spruce								
Sawtimber	164,795	--	--	--	2,163	6,391	--	8,225
Poletimber	84,474	--	--	--	--	1,977	--	538
Sapling & seedling	24,112	--	1,278	2,243	1,466	5,783	1,253	4,170
All stands	273,381	--	1,278	2,243	3,629	14,151	1,253	12,933
Black spruce								
Sawtimber	56,719	--	--	--	--	--	5,380	--
Poletimber	366,163	--	--	1,378	74,612	5,200	11,548	15,079
Sapling & seedling	87,192	1,255	9,928	--	9,471	16,271	7,789	12,599
All stands	510,074	1,255	9,928	1,378	84,083	21,471	24,717	27,678
Northern white-cedar								
Sawtimber	1,561,526	--	--	--	10,196	4,605	13,792	21,674
Poletimber	1,010,917	--	--	--	3,309	1,357	1,989	10,361
Sapling & seedling	87,066	--	1,175	2,438	1,850	4,121	3,557	8,062
All stands	2,659,509	--	1,175	2,438	15,355	10,083	19,338	40,097

(Table 23 continued on next page)

[1/] International 1/4-inch rule.

(Table 23 continued)

Forest type and stand-size class	Basal-area class (square feet per acre)						
	71-80	81-90	91-100	101-120	121-150	151-180	181+
Jack pine							
Sawtimber	88,405	67,664	81,033	68,082	--	--	--
Poletimber	86,242	46,099	136,337	53,283	80,249	--	954
Sapling & seedling	11,855	1,573	--	--	--	--	--
All stands	186,502	115,336	217,370	121,365	80,249	--	954
Red pine							
Sawtimber	88,986	43,477	53,846	123,381	295,193	109,671	80,192
Poletimber	82,651	11,560	4,181	102,408	93,201	154,172	83,433
Sapling & seedling	--	12,399	--	--	--	--	--
All stands	171,637	67,436	58,027	225,789	388,394	263,843	163,625
White pine							
Sawtimber	121,957	80,243	113,621	267,393	61,562	316,628	--
Poletimber	12,024	6,138	4,454	21,772	946	--	--
Sapling & seedling	--	--	--	--	--	--	--
All stands	133,981	86,381	118,075	289,165	62,508	316,628	--
Balsam fir							
Sawtimber	--	50,556	89,116	259,683	216,223	23,387	49,783
Poletimber	60,909	22,045	64,121	160,729	116,412	130,044	36,338
Sapling & seedling	8,320	12,877	10,850	3,636	5,712	--	--
All stands	69,229	85,478	164,087	424,048	338,347	153,431	86,121
White spruce							
Sawtimber	5,909	5,942	11,650	34,692	37,877	23,909	28,037
Poletimber	3,243	8,089	17,577	10,788	26,841	9,233	6,188
Sapling & seedling	7,919	--	--	--	--	--	--
All stands	17,071	14,031	29,227	45,480	64,718	33,142	34,225
Black spruce							
Sawtimber	13,234	4,931	--	5,010	28,164	--	--
Poletimber	13,439	7,051	41,258	83,931	51,934	27,321	33,412
Sapling & seedling	6,631	8,097	11,101	1,819	2,231	--	--
All stands	33,304	20,079	52,359	90,760	82,329	27,321	33,412
Northern white-cedar							
Sawtimber	26,032	--	70,056	292,098	297,544	338,872	486,657
Poletimber	17,905	19,854	33,466	108,187	250,569	239,400	324,520
Sapling & seedling	8,903	9,725	3,660	21,062	13,358	7,870	1,285
All stands	52,840	29,579	107,182	421,347	561,471	586,142	812,462

(Table 23 continued on next page)

(Table 23 continued)

Forest type and stand-size class	All classes	Basal-area class (square feet per acre) 0-10	11-20	21-30	31-40	41-50	51-60	61-70
Tamarack								
Sawtimber	28,761	--	--	4,381	2,822	7,818	--	--
Poletimber	39,715	--	--	--	1,272	2,366	5,747	7,031
Sapling & seedling	24,508	--	4,174	1,986	5,860	--	2,549	4,556
All stands	92,984	--	4,174	6,367	9,954	10,184	8,296	11,587
Oak-hickory								
Sawtimber	3,916,254	1,467	--	12,313	30,916	82,351	244,510	299,502
Poletimber	1,535,137	--	493	--	839	47,061	122,699	173,377
Sapling & seedling	310,946	3,086	18,539	11,521	63,789	102,620	31,059	70,999
All stands	5,762,337	4,553	19,032	23,834	95,544	232,032	398,268	543,878
Elm-ash-soft maple								
Sawtimber	2,380,406	--	--	14,632	54,896	96,719	55,046	128,525
Poletimber	831,808	--	2,645	4,690	21,179	39,496	13,139	58,568
Sapling & seedling	249,767	2,306	7,530	14,949	37,010	55,662	20,846	38,543
All stands	3,461,981	2,306	10,175	34,271	113,085	191,877	89,031	225,636
Maple-birch								
Sawtimber	15,379,590	--	4,671	--	37,486	150,161	130,721	479,602
Poletimber	6,277,708	--	555	4,511	15,559	62,775	67,950	252,140
Sapling & seedling	1,001,430	9,694	32,703	32,821	103,752	125,833	108,475	181,976
All stands	22,658,728	9,694	37,929	37,332	156,797	338,769	307,146	913,718
Aspen								
Sawtimber	2,624,567	--	2,224	3,216	30,675	124,739	54,326	166,293
Poletimber	2,766,926	--	698	3,951	38,025	59,138	85,645	216,637
Sapling & seedling	695,720	12,854	34,946	61,708	88,434	160,232	108,817	89,672
All stands	6,087,213	12,854	37,868	68,875	157,134	344,109	248,788	472,602
Paper birch								
Sawtimber	148,584	--	--	--	2,932	--	3,865	9,276
Poletimber	423,382	--	--	--	2,792	10,726	9,907	18,819
Sapling & seedling	28,465	574	--	2,463	1,458	6,405	3,864	7,435
All stands	600,431	574	--	2,463	7,182	17,131	17,636	35,530
Exotic								
Sawtimber	35,326	--	--	--	--	--	--	--
Poletimber	15,785	--	--	--	--	--	2,176	--
Sapling & seedling	5,365	--	--	--	--	--	--	--
All stands	56,476	--	--	--	--	--	2,176	--
Nonstocked	9,073	158	8,695	--	--	--	--	--
All types								
Sawtimber	29,527,941	1,467	10,257	44,613	220,394	567,091	627,381	1,318,639
Poletimber	15,292,481	--	6,790	26,678	177,631	360,576	384,901	893,142
Sapling & seedling	2,839,641	36,972	124,396	152,870	351,913	520,251	352,943	484,912
Nonstocked	9,073	158	8,695	--	--	--	--	--
All stands	47,669,136	38,597	150,138	224,161	749,938	1,447,918	1,365,225	2,696,693

(Table 23 continued on next page)

(Table 23 continued)

Forest type and stand-size class	Basal-area class (square feet per acre)						
	71-80	81-90	91-100	101-120	121-150	151-180	181+
Tamarack							
Sawtimber	7,709	--	--	--	6,031	--	--
Poletimber	5,862	10,894	3,174	3,369	--	--	--
Sapling & seedling	1,016	3,057	--	--	1,310	--	--
All stands	14,587	13,951	3,174	3,369	7,341	--	--
Oak-hickory							
Sawtimber	440,653	440,446	407,294	860,106	894,092	202,604	--
Poletimber	226,828	193,518	194,792	330,986	174,966	39,610	29,968
Sapling & seedling	1,825	1,085	4,345	2,078	--	--	--
All stands	669,306	635,049	606,431	1,193,170	1,069,058	242,214	29,968
Elm-ash-soft maple							
Sawtimber	238,498	143,601	143,651	488,570	697,577	271,157	47,534
Poletimber	101,528	54,451	167,813	122,620	142,492	94,058	9,129
Sapling & seedling	44,608	1,246	17,515	6,203	3,349	--	--
All stands	384,634	199,298	328,979	617,393	843,418	365,215	56,663
Maple-birch							
Sawtimber	1,011,334	840,695	1,850,071	3,267,339	5,037,120	1,845,429	724,961
Poletimber	412,043	419,085	734,211	1,489,505	1,997,049	751,708	70,617
Sapling & seedling	137,413	107,944	74,609	76,171	10,039	--	--
All stands	1,560,790	1,367,724	2,658,891	4,833,015	7,044,208	2,597,137	795,578
Aspen							
Sawtimber	225,450	183,154	288,768	338,059	711,149	311,577	184,937
Poletimber	221,533	291,090	353,370	452,867	639,785	270,166	134,021
Sapling & seedling	53,704	28,197	29,694	20,018	7,444	--	--
All stands	500,687	502,441	671,832	810,944	1,358,378	581,743	318,958
Paper birch							
Sawtimber	--	6,127	14,179	37,210	57,139	--	17,856
Poletimber	26,982	8,511	60,107	66,713	155,682	55,906	7,237
Sapling & seedling	1,959	2,845	--	1,462	--	--	--
All stands	28,941	17,483	74,286	105,385	212,821	55,906	25,093
Exotic							
Sawtimber	--	--	--	35,326	--	--	--
Poletimber	3,134	--	1,621	6,536	1,599	719	--
Sapling & seedling	2,527	--	2,838	--	--	--	--
All stands	5,661	--	4,459	41,862	1,599	719	--
Nonstocked	220	--	--	--	--	--	--
All types							
Sawtimber	2,268,167	1,866,836	3,123,285	6,076,949	8,339,671	3,443,234	1,619,957
Poletimber	1,274,323	1,098,385	1,816,482	3,013,694	3,731,725	1,772,337	735,817
Sapling & seedling	286,680	189,045	154,612	132,449	43,443	7,870	1,285
Nonstocked	220	--	--	--	--	--	--
All stands	3,829,390	3,154,266	5,094,379	9,223,092	12,114,839	5,223,441	2,357,059

Table 24.--Net volume of sawtimber on commercial forest land by species group and log grade, Michigan, 1980

(In thousand board feet)[1/]

Species group	All grades	Log grade			
		1	2	3	Tie and timber
SOFTWOODS					
White pine	2,606,707	174,297	297,188	1,664,999	470,223
Red pine	1,890,783	52,174	47,663	1,717,109	73,837
Jack pine	1,300,487	699	23,243	1,266,563	9,982
White spruce	1,395,518	--	60,704	1,334,814	--
Black spruce	364,731	794	2,810	361,127	--
Balsam fir	1,086,763	3,018	915	1,050,501	32,329
Hemlock	2,389,793	45,092	177,649	2,139,378	27,674
Tamarack	191,493	5,901	9,144	176,448	--
Northern white-cedar	2,648,562	24,300	52,827	2,571,435	--
Other softwoods	70,682	--	--	70,682	--
Total	13,945,519	306,275	672,143	12,353,056	614,045
HARDWOODS					
Select white oaks	1,791,072	111,280	370,165	1,008,281	301,346
Select red oaks	3,903,389	263,367	851,413	2,233,453	555,156
Other red oaks	931,164	61,896	139,542	564,605	165,121
Hickory	331,572	11,075	73,422	209,468	37,607
Yellow birch	1,516,165	164,035	457,493	796,756	97,881
Hard maple	6,997,860	790,783	1,920,403	3,828,055	458,619
Soft maple	4,813,226	463,448	999,884	3,099,249	250,645
Beech	1,240,413	54,024	192,087	863,499	130,803
Ash	1,469,167	208,719	362,792	839,345	58,311
Balsam poplar	811,808	51,942	127,832	527,115	104,919
Cottonwood	291,306	53,582	50,377	179,926	7,421
Bigtooth aspen	1,842,998	41,419	335,989	1,345,127	120,463
Quaking aspen	3,460,407	78,242	417,725	2,481,202	483,238
Basswood	1,772,955	278,489	551,132	888,553	54,781
Yellow-poplar	87,069	25,987	20,980	38,059	2,043
Black walnut	84,707	4,713	1,043	67,999	10,952
Black cherry	593,837	36,257	3,463	479,208	74,909
Butternut	8,952	--	--	8,952	--
Elm	632,956	63,207	233,541	274,999	61,209
Paper birch	910,295	17,662	126,164	690,637	75,832
Other hardwoods	232,299	14,443	29,848	153,757	34,251
Total	33,723,617	2,794,570	7,265,295	20,578,245	3,085,507
All species	47,669,136	3,100,845	7,937,438	32,931,301	3,699,552

[1/] International 1/4-inch rule.

Table 25.--Net volume of growing stock on commercial forest land by species groups[1/] and county, Michigan, 1980

(In thousand cubic feet)

County	All species	Softwoods				Hardwoods				
		Pine	Spruce and balsam fir	Northern white-cedar	Other softwoods	Oaks	Hard maple	Soft maple	Aspen	Other hardwoods
EASTERN UPPER PENINSULA										
Alger	633,168	47,540	60,111	56,335	39,262	72	154,397	105,298	20,542	149,611
Chippewa	741,628	113,460	126,471	77,642	17,923	6,765	75,681	75,844	109,544	138,298
Delta	595,253	65,627	109,432	81,695	22,391	1,996	49,016	62,394	81,602	121,100
Luce	509,662	80,999	63,782	64,408	32,522	819	69,793	83,532	37,394	76,413
Mackinac	591,900	45,185	108,453	82,242	14,533	1,733	70,754	51,146	86,173	131,681
Menominee	458,744	20,569	40,986	102,783	25,122	10,594	66,268	28,540	54,172	109,710
Schoolcraft	504,389	85,819	69,661	67,743	25,588	86	50,509	70,699	40,979	93,305
Total	4,034,744	459,199	578,896	532,848	177,341	22,065	536,418	477,453	430,406	820,118
WESTERN UPPER PENINSULA										
Baraga	719,048	21,646	82,015	43,425	62,996	3,190	209,963	112,115	46,468	137,230
Dickinson	383,517	14,604	64,692	40,428	6,425	4,423	58,492	13,579	71,733	109,141
Gogebic	763,990	20,404	97,623	40,629	53,263	6,710	199,816	60,607	96,173	188,765
Houghton	718,181	40,391	59,926	28,043	36,211	10,270	223,250	102,832	83,857	133,401
Iron	785,974	45,338	135,241	25,712	33,593	6,354	185,935	54,797	121,792	177,212
Keweenaw	292,375	14,254	40,931	49,271	671	17,007	62,350	38,908	19,423	49,560
Marquette	1,264,465	139,207	175,883	78,037	76,888	33,636	268,226	164,385	129,608	198,595
Ontonagon	857,481	36,354	93,327	24,504	46,737	4,255	196,678	81,286	178,447	195,893
Total	5,785,031	332,198	749,638	330,049	316,784	85,845	1,404,710	628,509	747,501	1,189,797

(Table 25 continued on next page)

(Table 25 continued)

NORTHERN LOWER PENINSULA

County	All species	Softwoods				Hardwoods				
		Pine	Spruce and balsam fir	Northern white-cedar	Other softwoods	Oaks	Hard maple	Soft maple	Aspen	Other hardwoods
Alcona	313,422	40,462	13,155	16,470	1,183	88,518	7,547	28,078	58,774	59,235
Alpena	229,438	14,294	24,206	30,438	1,662	22,000	2,760	22,506	68,328	43,244
Antrim	204,488	1,861	4,526	10,369	6,025	--	60,526	20,066	34,591	66,524
Arenac	98,882	6,685	1,853	2,299	2,306	10,970	677	15,710	34,975	23,407
Bay	19,562	--	--	--	--	427	--	3,835	5,967	9,333
Benzie	143,591	9,391	779	2,960	6,706	978	47,710	23,314	13,112	38,641
Charlevoix	223,281	10,563	10,741	25,800	3,249	2,808	51,006	10,929	24,654	83,531
Cheboygan	366,166	39,281	28,795	40,998	5,380	12,666	50,720	22,792	81,759	83,775
Clare	198,788	30,218	1,872	9,898	1,814	54,814	1,838	31,427	47,939	18,968
Crawford	229,246	74,347	4,405	6,567	1,342	79,073	10,422	12,344	27,287	13,459
Emmet	256,988	3,249	9,408	12,099	5,102	5,729	77,468	16,725	56,687	70,521
Gladwin	161,384	8,749	1,053	1,184	199	17,458	0	26,163	77,030	29,548
Grand Traverse	164,917	30,698	184	11,306	7,483	20,109	18,654	21,552	36,134	18,797
Iosco	225,748	71,316	7,241	20,134	4,286	28,405	1,464	29,020	32,988	30,894
Isabella	71,290	801	113	4,716	4,750	13,547	530	11,909	24,449	10,475
Kalkaska	190,384	42,266	7,065	8,259	3,292	15,685	38,195	19,439	21,527	34,656
Lake	303,726	78,986	279	12,703	5,811	124,947	3,949	21,004	34,902	21,145
Leelanau	112,604	4,655	395	4,698	2,198	3,315	43,409	2,814	2,390	48,730
Manistee	244,928	32,801	363	6,884	3,340	49,935	41,325	49,949	21,847	38,484
Mason	152,245	18,830	278	4,153	4,634	49,681	6,870	24,836	29,207	13,756
Mecosta	104,234	8,326	938	5,043	3,230	11,495	6,226	12,095	33,967	22,914
Midland	135,485	8,308	--	--	1,234	21,020	211	29,714	48,921	26,077
Missaukee	185,718	16,998	4,046	10,824	4,355	26,936	19,964	32,510	40,245	29,840
Montmorency	229,593	37,289	9,494	14,493	4,604	39,815	18,556	24,287	40,390	40,665
Newaygo	326,936	56,204	358	5,210	7,099	129,375	8,743	49,776	33,858	36,313
Oceana	147,241	13,121	502	3,757	5,806	42,411	6,902	28,501	17,263	28,978
Ogemaw	226,851	22,487	4,600	14,254	404	47,173	5,415	23,790	69,022	39,706
Osceola	196,236	3,963	3,079	17,433	8,845	18,767	29,220	26,357	44,246	44,326
Oscoda	248,446	85,215	5,362	7,553	226	61,780	6,524	13,184	47,587	21,015
Otsego	286,118	41,242	11,361	12,226	1,922	12,777	78,851	18,681	35,522	73,536
Presque Isle	253,992	25,630	22,707	61,444	3,943	17,082	9,654	11,638	51,464	50,430
Roscommon	305,689	51,511	8,558	32,523	1,292	96,221	1,442	31,818	56,411	25,913
Wexford	267,049	75,429	2,860	14,421	6,461	26,890	36,206	31,592	31,139	42,051
Total	6,824,666	965,176	190,576	431,116	120,183	1,152,807	692,984	748,355	1,284,582	1,238,887

(Table 25 continued on next page)

(Table 25 continued)

SOUTHERN LOWER PENINSULA

County	All species	Softwoods				Hardwoods				
		Pine	Spruce and balsam fir	Northern white-cedar	Other softwoods	Oaks	Hard maple	Soft maple	Aspen	Other hardwoods
Allegan	160,301	27,845	--	--	5,245	56,637	1,542	21,681	6,970	40,381
Barry	147,582	3,697	1,082	--	1,009	60,818	17,838	21,122	2,539	39,477
Berrien	84,356	--	--	--	--	10,467	12,285	10,411	1,507	49,686
Branch	55,938	--	--	--	188	9,803	1,329	22,115	1,327	21,176
Calhoun	85,534	1,142	--	--	679	13,569	1,143	17,244	2,036	49,721
Cass	68,751	--	--	--	1,138	10,587	1,665	17,254	1,310	36,797
Clinton	19,817	--	--	--	--	4,507	538	5,533	1,009	8,230
Eaton	41,076	--	--	--	389	3,858	4,601	5,318	414	26,496
Genesee	37,485	--	--	--	--	10,648	4,558	7,753	886	13,640
Gratiot	29,548	1,168	--	--	--	11,819	1,190	7,814	2,247	5,310
Hillsdale	19,791	--	--	--	--	2,246	5,088	1,657	0	10,800
Huron	37,011	--	--	--	233	--	--	1,921	12,350	22,507
Ingham	44,819	135	166	--	--	8,636	3,378	4,774	3,810	23,920
Ionia	26,429	--	--	--	267	6,761	1,249	3,353	2,522	12,277
Jackson	95,732	--	--	--	205	43,985	--	6,930	3,619	40,993
Kalamazoo	47,733	5,412	256	--	5,966	8,737	308	7,611	3,483	15,960
Kent	117,307	1,375	--	--	1,043	50,336	9,246	24,980	5,924	24,403
Lapeer	64,384	2,637	185	--	206	19,783	6,901	11,551	3,315	19,806
Lenawee	44,036	--	--	--	--	8,229	6,598	5,462	1,691	22,056
Livingston	71,575	4,290	--	--	2,479	38,829	--	10,413	1,639	13,925
Macomb	26,901	--	--	662	810	970	3,560	11,309	189	9,401
Monroe	45,275	--	--	--	--	18,170	1,919	4,325	0	20,861
Montcalm	147,371	16,691	--	161	2,246	52,569	1,499	24,139	18,177	31,889
Muskegon	160,911	36,428	--	21	3,501	71,253	662	24,178	13,447	11,421
Oakland	62,889	730	--	--	--	31,024	827	6,571	2,592	21,145
Ottawa	93,034	12,384	--	--	8,220	22,358	3,544	21,360	1,594	23,574
Saginaw	60,154	1,222	--	--	142	21,155	2,739	8,129	8,045	18,722
St. Clair	91,786	7,713	--	--	1,236	27,420	5,114	7,622	3,654	39,027
St. Joseph	74,003	322	214	--	169	19,696	973	10,666	8,332	33,631
Sanilac	21,859	--	--	--	--	542	--	1,758	8,775	10,784
Shiawassee	72,960	--	--	--	--	23,823	2,543	12,426	2,724	31,444
Tuscola	77,239	1,012	--	3,085	330	4,294	5,406	19,149	23,076	20,887
Van Buren	99,113	4,801	--	--	261	22,177	5,117	19,675	2,778	44,304
Washtenaw	83,489	--	--	--	797	41,533	996	7,068	1,911	31,184
Wayne	43,170	--	--	--	--	20,906	304	5,163	1,011	15,786
Total	2,459,359	129,004	1,903	3,929	36,759	758,145	114,660	398,435	154,903	861,621
All units	19,103,800	1,885,577	1,521,013	1,297,942	651,067	2,018,862	2,748,772	2,252,752	2,617,392	4,110,423

1/ Species groups: other softwoods - primarily hemlock and tamarack; hard maple - sugar maple and black maple; soft maple - red maple and silver maple; other hardwoods - primarily hickory, yellow birch, beech, ash, balsam poplar, cottonwood, basswood, black walnut, black cherry, butternut, elm, and paper birch.

Table 26.--Net volume of sawtimber on commercial forest land by species groups[1/] and county, Michigan, 1980

(In thousand board feet)[2/]

County	All species	Softwoods				Hardwoods				
		Pine	Spruce and balsam fir	Northern white-cedar	Other softwoods	Oaks	Hard maple	Soft maple	Aspen	Other hardwoods
EASTERN UPPER PENINSULA										
Alger	1,888,985	171,606	121,978	153,667	201,655	--	452,443	234,842	47,845	504,949
Chippewa	1,659,894	281,372	224,959	158,395	75,491	22,147	162,544	166,851	223,007	345,128
Delta	1,134,546	182,729	192,669	113,780	85,011	8,531	116,505	76,781	108,284	250,256
Luce	1,466,285	307,316	105,318	177,581	148,731	546	223,358	194,900	75,217	233,318
Mackinac	1,240,067	159,628	210,043	132,121	53,326	2,236	177,115	85,204	148,235	272,159
Menominee	833,200	93,829	56,996	150,605	64,384	32,908	109,642	47,813	75,277	201,746
Schoolcraft	1,172,230	297,223	108,744	110,131	101,337	--	124,729	140,652	72,584	216,830
Total	9,395,207	1,493,703	1,020,707	996,280	729,935	66,368	1,366,336	947,043	750,449	2,024,386
WESTERN UPPER PENINSULA										
Baraga	2,253,770	89,154	170,599	163,114	320,593	9,741	700,785	264,384	124,313	411,087
Dickinson	698,953	62,812	103,940	69,513	10,092	18,140	67,583	12,024	123,693	231,156
Gogebic	1,926,524	57,673	190,692	136,366	254,132	20,201	535,635	108,544	202,912	420,369
Houghton	1,995,226	135,297	131,417	101,157	176,776	41,763	664,036	198,769	221,092	324,919
Iron	1,957,638	193,451	278,680	77,832	146,210	20,918	499,633	115,743	251,532	373,639
Keweenaw	830,853	73,835	97,469	155,233	2,570	70,995	171,170	87,305	46,280	125,996
Marquette	3,406,308	601,269	326,287	204,497	366,886	105,533	781,680	266,336	265,560	488,260
Ontonagon	2,176,940	123,108	210,503	86,665	228,793	14,933	589,364	115,604	367,393	440,577
Total	15,246,212	1,336,599	1,509,587	994,377	1,506,052	302,224	4,009,886	1,168,709	1,602,775	2,816,003

(Table 26 continued on next page)

(Table 26 continued)

NORTHERN LOWER PENINSULA

County	All species	Softwoods				Hardwoods				
		Pine	Spruce and balsam fir	Northern white-cedar	Other softwoods	Oaks	Hard maple	Soft maple	Aspen	Other hardwoods
Alcona	727,582	142,193	29,762	30,900	5,833	204,917	11,070	55,391	122,631	124,885
Alpena	492,107	57,617	52,600	57,222	4,459	51,746	3,921	45,207	155,184	64,151
Antrim	377,697	8,477	10,577	26,988	21,314	--	88,241	36,428	70,692	114,980
Arenac	199,998	17,707	--	691	2,507	29,977	--	28,175	70,913	50,028
Bay	46,778	--	--	--	--	1,845	--	10,030	14,286	20,617
Benzie	328,817	1,255	--	7,372	19,521	3,756	94,680	44,233	29,987	128,013
Charlevoix	508,496	41,698	19,850	30,721	9,373	11,494	97,973	19,884	87,645	189,858
Cheboygan	732,066	130,777	57,050	60,703	17,418	33,773	48,252	24,600	191,647	167,846
Clare	471,667	67,713	1,453	12,365	5,677	189,492	7,863	49,525	104,096	33,483
Crawford	413,157	195,389	3,834	2,834	6,727	131,191	7,858	4,482	31,319	29,523
Emmet	540,251	8,732	14,337	11,168	14,947	22,032	101,823	16,063	173,728	177,421
Gladwin	329,985	38,721	2,287	2,029	1,074	41,230	--	23,532	180,268	40,844
Grand Traverse	402,688	72,564	--	15,929	17,073	64,670	48,298	49,256	86,919	47,979
Iosco	488,497	170,730	14,932	31,517	20,107	47,785	4,944	61,470	71,113	65,899
Isabella	164,022	2,347	--	3,784	10,434	59,425	1,993	33,275	35,575	17,189
Kalkaska	368,373	112,243	9,748	14,438	6,400	43,997	52,453	23,615	37,899	67,580
Lake	677,970	161,110	--	10,070	6,061	354,939	6,484	26,172	64,503	48,631
Leelanau	334,699	12,647	--	5,051	8,263	15,594	94,814	12,742	7,168	178,420
Manistee	678,216	58,298	--	10,023	8,217	155,141	133,061	156,115	40,566	116,795
Mason	371,064	36,983	--	8,681	8,105	151,874	21,550	74,479	38,601	30,791
Mecosta	255,640	28,469	--	6,551	11,817	47,043	26,285	24,648	76,658	34,169
Midland	317,391	35,636	--	--	5,598	73,929	--	81,598	72,906	47,724
Missaukee	408,816	55,450	6,506	24,512	5,700	103,854	28,855	59,171	66,033	58,735
Montmorency	456,718	111,503	16,412	14,613	5,944	102,817	20,445	21,866	90,239	72,879
Newaygo	869,882	119,322	--	9,388	15,277	412,525	21,731	139,175	53,951	98,513
Oceana	384,521	29,661	--	4,040	13,835	147,203	15,787	76,242	29,552	68,201
Ogemaw	402,505	47,198	5,572	17,659	1,223	88,262	3,256	38,680	141,617	59,038
Osceola	562,103	14,854	3,774	34,045	37,301	63,417	79,125	56,062	147,669	125,856
Oscoda	563,867	242,294	8,969	14,690	749	155,227	6,518	16,373	78,714	40,333
Otsego	564,076	140,038	15,044	18,541	10,378	41,845	89,465	23,082	67,062	158,621
Presque Isle	451,144	77,895	35,563	99,105	8,149	38,859	12,363	13,502	89,192	76,516
Roscommon	680,326	195,916	6,135	51,881	1,967	220,516	--	43,345	124,846	35,720
Wexford	511,063	114,529	1,067	15,695	9,330	109,610	59,467	61,654	52,297	87,414
Total	15,082,182	2,549,966	315,472	653,206	320,778	3,219,985	1,188,575	1,450,072	2,705,476	2,678,652

(Table 26 continued on next page)

(Table 26 continued)

SOUTHERN LOWER PENINSULA

County	All species	Softwoods				Hardwoods				
		Pine	Spruce and balsam fir	Northern white-cedar	Other softwoods	Oaks	Hard maple	Soft maple	Aspen	Other hardwoods
Allegan	492,180	71,134	--	--	4,995	195,853	6,499	78,264	10,011	125,424
Barry	537,729	9,830	538	--	2,175	264,323	79,424	65,286	1,891	114,262
Berrien	275,389	--	--	--	--	35,117	32,882	24,298	1,642	181,450
Branch	181,734	--	--	--	872	44,207	3,160	76,340	3,163	53,992
Calhoun	305,140	1,547	--	--	1,522	69,475	3,129	55,811	3,680	169,976
Cass	236,371	--	--	--	--	49,622	6,470	73,364	--	106,915
Clinton	50,482	--	--	--	--	16,550	1,133	14,242	1,611	16,946
Eaton	109,286	--	--	--	--	15,065	13,264	22,617	2,601	55,739
Genesee	131,120	--	--	--	--	43,238	23,107	34,137	--	30,638
Gratiot	103,047	2,707	--	--	--	38,753	4,106	33,015	4,938	19,528
Hillsdale	70,940	--	--	--	--	11,837	26,994	3,665	--	28,444
Huron	86,377	--	--	--	--	--	--	1,893	20,950	63,534
Ingham	149,933	660	--	--	--	36,616	16,107	15,669	13,493	67,388
Ionia	90,927	--	--	--	--	35,127	3,557	11,983	3,894	36,366
Jackson	339,305	--	--	--	--	199,038	--	28,562	11,238	100,467
Kalamazoo	149,446	22,306	--	--	12,243	37,892	--	27,789	7,605	41,611
Kent	312,539	6,011	--	--	1,070	165,445	35,213	49,936	--	54,864
Lapeer	175,221	950	708	--	--	74,567	20,877	37,123	1,403	39,593
Lenawee	158,283	--	--	--	--	42,055	28,687	11,064	6,305	70,172
Livingston	266,465	10,032	--	--	8,070	172,238	--	32,138	4,227	39,760
Macomb	97,340	--	--	--	3,799	2,828	16,422	39,432	--	34,859
Monroe	167,546	--	--	--	--	82,093	12,271	22,239	--	50,943
Montcalm	392,071	55,673	--	212	5,166	167,569	1,595	58,336	29,508	74,012
Muskegon	476,093	132,499	--	26	19,116	212,241	4	71,006	21,253	19,948
Oakland	251,416	2,605	--	--	--	148,702	3,061	28,203	--	68,845
Ottawa	321,864	32,461	--	--	30,273	79,066	13,198	70,418	--	96,448
Saginaw	148,425	6,564	--	--	--	78,557	13,258	17,463	6,654	25,929
St. Clair	313,859	41,363	--	--	2,914	101,224	14,148	27,726	1,351	125,133
St. Joseph	283,981	1,730	--	--	--	94,407	--	42,052	24,724	121,068
Sanilac	41,492	--	--	--	--	1,244	--	6,703	14,555	18,990
Shiawassee	250,082	--	--	--	--	92,834	7,722	45,559	10,594	93,373
Tuscola	178,462	6,152	--	4,461	--	20,276	17,186	49,535	32,672	48,180
Van Buren	293,169	13,485	--	--	--	86,559	24,205	43,387	2,022	123,511
Washtenaw	341,725	--	--	--	2,988	220,826	3,723	18,544	1,762	93,882
Wayne	166,096	--	--	--	--	101,604	1,663	9,602	957	52,270
Total	7,945,535	417,709	1,246	4,699	95,203	3,037,048	433,065	1,247,401	244,704	2,464,460
All units	47,669,136	5,797,977	2,847,012	2,648,562	2,651,968	6,625,625	6,997,862	4,813,225	5,303,404	9,983,501

1/ Species groups: other softwoods - primarily hemlock and tamarack; hard maple - sugar maple and black maple; soft maple - red maple and silver maple; other hardwoods - primarily hickory, yellow birch, beech, ash, balsam poplar, cottonwood, basswood, black walnut, black cherry, butternut, elm, and paper birch.

2/ International 1/4-inch rule.

Table 27.--Net volume of short-log trees on commercial forest land by species group and diameter class, Michigan, 1980

(In thousand cubic feet)

Species group	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS											
White pine	4,499	1,538	1,198	556	410	163	146	75	413	--	--
Red pine	696	370	224	--	--	102	--	--	--	--	--
Jack pine	3,797	2,289	504	622	194	188	--	--	--	--	--
White spruce	1,592	798	222	251	--	226	95	--	--	--	--
Black spruce	360	284	76	--	--	--	--	--	--	--	--
Balsam fir	2,743	1,153	1,088	199	--	303	--	--	--	--	--
Hemlock	12,079	3,549	2,349	1,966	1,083	1,178	722	581	530	121	--
Tamarack	515	395	60	--	60	--	--	--	--	--	--
Northern white-cedar	31,451	9,687	7,752	4,720	3,203	1,967	1,618	912	1,371	221	--
Other softwoods	382	227	155	--	--	--	--	--	--	--	--
Total	58,114	20,290	13,628	8,314	4,950	4,127	2,581	1,568	2,314	342	--
HARDWOODS											
Select white oaks	7,988	--	2,484	1,885	655	--	713	290	1,447	514	--
Select red oaks	16,310	--	4,577	2,945	1,617	1,991	1,693	1,543	1,211	733	--
Other red oaks	3,756	--	1,283	588	456	365	64	--	470	530	--
Hickory	1,155	--	172	283	250	202	--	248	--	--	--
Yellow birch	28,097	--	5,149	3,923	4,624	2,599	3,195	1,754	3,863	2,990	--
Hard maple	53,500	--	14,878	8,901	6,951	6,222	4,708	2,068	6,669	2,818	285
Soft maple	35,290	--	10,724	6,464	7,034	3,205	1,773	2,035	2,646	801	608
Beech	14,704	--	2,118	2,832	1,336	1,780	1,516	1,696	2,817	609	--
Ash	7,712	--	2,692	1,624	785	751	207	569	792	--	292
Balsam poplar	1,692	--	984	129	229	183	167	--	--	--	--
Cottonwood	92	--	--	--	--	--	--	92	--	--	--
Bigtooth aspen	8,057	--	3,096	1,983	1,281	761	369	319	248	--	--
Quaking aspen	21,989	--	8,781	5,393	4,223	1,899	959	639	95	--	--
Basswood	6,135	--	2,065	1,105	1,076	484	530	629	114	132	--
Yellow-poplar	--	--	--	--	--	--	--	--	--	--	--
Black walnut	288	--	--	--	--	--	--	--	--	288	--
Black cherry	6,054	--	3,077	1,012	1,017	674	274	--	--	--	--
Butternut	--	--	--	--	--	--	--	--	--	--	--
Elm	4,825	--	2,144	1,389	106	597	388	--	201	--	--
Paper birch	8,451	--	4,437	1,377	861	617	712	281	87	79	--
Other hardwoods	2,221	--	646	660	102	142	--	--	--	334	337
Total	228,316	--	69,307	42,493	32,603	22,472	17,268	12,163	20,660	9,828	1,522
All species	286,430	20,290	82,935	50,807	37,553	26,599	19,849	13,731	22,974	10,170	1,522

Table 28.--Net volume of short-log trees on commercial forest land by species group and diameter class, Michighan, 1980

(In thousand board feet)[1/]

Species group	All classes	Diameter class (inches at breast height) 9.0 10.9	11.0- 12.9	13.0- 14.9	15.0- 16.9	17.0- 18.9	19.0- 20.9	21.0- 22.9	23.0- 28.9	29.0- 38.9	39.0+
SOFTWOODS											
White pine	17,892	7,565	4,658	1,967	1,396	502	560	180	1,064	--	--
Red pine	2,871	1,631	938	--	--	302	--	--	--	--	--
Jack pine	16,843	11,455	1,988	2,229	753	418	--	--	--	--	--
White spruce	6,356	3,737	845	821	--	676	277	--	--	--	--
Black spruce	1,590	1,177	413	--	--	--	--	--	--	--	--
Balsam fir	10,037	4,819	3,989	700	--	529	--	--	--	--	--
Hemlock	44,323	15,008	9,187	6,997	3,426	3,659	2,749	1,664	1,374	259	--
Tamarack	2,409	1,921	302	--	186	--	--	--	--	--	--
Northern white-cedar	92,977	37,606	24,852	12,557	7,373	3,706	3,156	1,590	1,953	184	--
Other softwoods	2,188	1,321	867	--	--	--	--	--	--	--	--
Total	197,486	86,240	48,039	25,271	13,134	9,792	6,742	3,434	4,391	443	--
HARDWOODS											
Select white oaks	22,490	--	6,956	5,455	1,798	--	1,949	910	3,672	1,750	--
Select red oaks	46,701	--	13,910	8,407	4,561	5,331	4,932	4,370	3,483	1,707	--
Other red oaks	11,314	--	4,371	1,715	1,283	1,049	184	--	1,362	1,350	--
Hickory	3,635	--	1,062	797	282	791	--	703	--	--	--
Yellow birch	116,473	--	28,660	19,776	20,096	10,544	11,984	7,156	10,380	7,877	--
Hard maple	139,365	--	41,298	26,167	19,234	18,036	10,888	4,466	13,907	4,913	456
Soft maple	106,265	--	32,483	18,450	20,650	9,544	5,648	6,652	8,014	2,431	2,393
Beech	40,524	--	5,247	7,457	3,480	4,966	4,200	4,795	8,026	2,353	--
Ash	20,333	--	7,670	3,991	1,798	2,159	587	2,045	1,554	--	529
Balsam poplar	4,286	--	2,493	197	641	440	515	--	--	--	--
Cottonwood	337	--	--	--	--	--	--	337	--	--	--
Bigtooth aspen	19,855	--	8,633	4,629	2,963	1,784	732	671	443	--	--
Quaking aspen	58,989	--	24,893	14,478	10,695	4,768	2,751	1,251	153	--	--
Basswood	17,449	--	5,530	2,882	3,472	1,216	1,155	2,470	343	381	--
Yellow-poplar	--	--	--	--	--	--	--	--	--	--	--
Black walnut	246	--	--	--	--	--	--	--	--	246	--
Black cherry	16,980	--	9,377	2,392	2,494	1,905	812	--	--	--	--
Butternut	--	--	--	--	--	--	--	--	--	--	--
Elm	14,330	--	6,812	3,710	300	1,791	1,112	--	605	--	--
Paper birch	24,789	--	11,854	3,993	2,601	2,224	2,521	893	404	299	--
Other hardwoods	5,681	--	2,173	1,444	162	379	--	--	--	759	764
Total	670,042	--	213,422	125,940	96,510	66,927	49,970	36,719	52,346	24,066	4,142
All species	867,528	86,240	261,461	151,211	109,644	76,719	56,712	40,153	56,737	24,509	4,142

[1/] International 1/4-inch rule.

Table 29.--Net annual growth of growing stock on commercial forest land by softwoods and hardwoods, Michigan 1965 and 1979

(In million cubic feet)

Species	1/ 1965	1979
Softwoods	141.0	205.5
Hardwoods	363.7	472.3
All species	504.7	677.8

1/ Figures have been adjusted from those published after the 1966 survey to conform to 1979 volumes because of changes in survey definitions and procedures.

Table 30.--Net annual growth of growing stock on commercial forest land by species group and Forest Survey Unit, Michigan, 1979

(In thousand cubic feet)

Species group	All Units	Forest Survey Unit: Eastern Upper Peninsula	Western Upper Peninsula	Northern Lower Peninsula	Southern Lower Peninsula
SOFTWOODS					
White pine	19,345	4,426	4,794	7,359	2,766
Red pine	44,857	6,437	3,030	32,209	3,181
Jack pine	26,700	7,527	3,999	14,588	586
White spruce	23,053	7,252	12,811	2,483	507
Black spruce	12,587	6,570	4,936	1,081	--
Balsam fir	24,608	6,263	16,748	1,591	6
Hemlock	10,814	3,090	6,260	1,360	104
Tamarack	161	849	841	-1,568	39
Northern white-cedar	39,369	17,080	7,331	14,711	247
Other softwoods	3,977	51	86	2,584	1,256
Total	205,471	59,545	60,836	76,398	8,692
HARDWOODS					
Select white oaks	12,566	12	17	5,645	6,892
Select red oaks	33,886	816	2,599	21,281	9,190
Other red oaks	8,388	--	--	4,565	3,823
Hickory	2,871	--	--	50	2,821
Yellow birch	9,329	1,621	6,723	799	186
Hard maple	94,457	18,589	49,016	23,690	3,162
Soft maple	113,426	20,833	31,444	42,752	18,397
Beech	6,163	4,169	11	1,378	605
Ash	39,045	6,172	7,914	13,059	11,900
Balsam poplar	4,481	2,093	917	1,226	245
Cottonwood	2,500	15	6	322	2,157
Bigtooth aspen	36,330	1,956	2,295	28,441	3,638
Quaking aspen	52,163	10,834	15,664	20,759	4,906
Basswood	22,318	2,020	7,530	9,876	2,892
Yellow-poplar	400	--	--	--	400
Black walnut	796	--	--	3	793
Black cherry	16,830	1,989	2,109	5,876	6,856
Butternut	99	--	--	7	92
Elm	-12,374	-5,230	-1,291	-2,502	-3,351
Paper birch	25,532	6,791	8,873	9,155	713
Other hardwoods	3,080	10	8	267	2,795
Total	472,286	72,690	133,835	186,649	79,112
All species	677,757	132,235	194,671	263,047	87,804

Table 31.--Net annual growth of sawtimber on commercial forest land by species group and Forest Survey Unit, Michigan, 1979

(In thousand board feet)[1/]

Species group	All Units	Forest Survey Unit: Eastern Upper Peninsula	Western Upper Peninsula	Northern Lower Peninsula	Southern Lower Peninsula
SOFTWOODS					
White pine	108,617	25,973	25,759	39,030	17,855
Red pine	117,205	23,613	12,329	73,439	7,824
Jack pine	104,334	23,253	21,954	56,093	3,034
White spruce	95,051	33,520	53,710	7,748	73
Black spruce	10,896	5,452	5,499	-55	--
Balsam fir	66,895	15,119	44,394	7,348	34
Hemlock	63,350	19,709	37,543	5,597	501
Tamarack	5,070	3,203	3,722	-1,882	27
Northern white-cedar	105,695	40,382	32,141	32,964	208
Other softwoods	9,741	387	8	4,288	5,058
Total	686,854	190,611	237,059	224,570	34,614
HARDWOODS					
Select white oaks	68,022	22	104	25,985	41,911
Select red oaks	186,674	2,758	15,496	113,864	54,556
Other red oaks	36,495	--	--	17,573	18,922
Hickory	15,022	--	--	128	14,894
Yellow birch	32,273	8,178	19,639	3,846	610
Hard maple	288,837	65,882	139,326	69,970	13,659
Soft maple	301,091	55,522	79,450	109,124	56,995
Beech	24,013	18,805	8	2,969	2,231
Ash	109,978	12,098	31,615	38,964	27,301
Balsam poplar	25,884	8,986	4,484	10,606	1,808
Cottonwood	9,610	77	27	1,025	8,481
Bigtooth aspen	143,373	4,336	17,011	111,076	10,950
Quaking aspen	250,279	58,263	93,060	90,673	8,283
Basswood	95,669	8,150	29,144	50,875	7,500
Yellow-poplar	737	--	--	--	737
Black walnut	2,089	--	--	--	2,089
Black cherry	45,841	8,833	4,548	12,076	20,384
Butternut	156	--	--	43	113
Elm	-13,924	-12,244	1,630	-1,315	-1,995
Paper birch	65,409	17,076	28,787	19,022	524
Other hardwoods	9,990	13	16	2,273	7,688
Total	1,697,518	256,755	464,345	678,777	297,641
All species	2,384,372	447,366	701,404	903,347	332,255

[1/] International 1/4-inch rule.

Table 32.--Net annual growth of growing stock on commercial forest land by species group and ownership class, Michigan, 1979

(In thousand cubic feet)

Species group	All owners	Ownership class									
		National Forest	Bureau of Land Mgmt.	Misc. federal	Indian	State	County & municipal	Forest industry	Farmer	Misc. priv.-corp.	Misc. priv.-indiv.
SOFTWOODS											
White pine	19,345	2,077	--	28	--	5,165	156	1,829	2,063	2,516	5,511
Red pine	44,857	18,607	--	52	--	11,423	823	593	4,638	2,515	6,206
Jack pine	26,700	8,287	--	179	--	10,776	451	575	797	688	4,947
White spruce	23,053	4,308	--	103	99	3,770	214	5,095	1,934	2,772	4,758
Black spruce	12,587	2,709	--	1	6	3,790	115	2,183	704	828	2,251
Balsam fir	24,608	4,709	--	59	5	2,932	187	5,763	2,750	2,454	5,749
Hemlock	10,814	1,346	--	5	47	1,205	107	3,619	1,047	1,063	2,375
Tamarack	161	-97	--	--	2	937	76	251	-307	-387	-314
Northern white-cedar	39,369	2,516	--	6	8	11,191	164	6,717	6,972	2,799	8,996
Other softwoods	3,977	12	--	--	--	107	--	--	1,112	323	2,423
Total	205,471	44,474	--	433	167	51,296	2,293	26,625	21,710	15,571	42,902
HARDWOODS											
Select white oak	12,566	1,298	--	107	--	1,730	77	29	3,537	649	5,139
Select red oaks	33,886	897	--	7	5	8,042	437	976	6,341	3,480	13,701
Other red oaks	8,388	3,008	--	22	--	849	78	33	1,463	301	2,634
Hickory	2,871	--	--	--	--	215	26	--	1,680	35	915
Yellow birch	9,329	1,091	--	31	43	1,035	43	2,376	663	1,957	2,090
Hard maple	94,457	10,110	--	10	227	12,815	1,458	21,066	16,017	9,986	22,768
Soft maple	113,426	10,838	--	40	213	21,603	1,158	13,395	21,127	11,382	33,670
Beech	6,163	1,133	--	--	--	563	12	1,770	766	444	1,475
Ash	39,045	2,045	--	7	108	5,049	519	3,917	12,589	2,717	12,094
Balsam poplar	4,481	-150	--	--	1	1,185	3	526	1,220	234	1,462
Cottonwood	2,500	--	--	--	--	69	--	4	1,444	195	788
Bigtooth aspen	36,330	3,583	--	--	49	9,305	394	399	5,630	3,064	13,906
Quaking aspen	52,163	5,967	--	123	87	10,043	660	4,054	10,175	5,054	16,000
Basswood	22,318	1,970	--	--	10	3,994	197	2,058	6,207	1,987	5,895
Yellow-poplar	400	--	--	--	--	0	--	--	174	3	223
Black walnut	796	--	--	--	--	0	--	--	300	11	485
Black cherry	16,830	1,695	--	--	5	2,557	388	1,152	5,058	1,208	4,767
Butternut	99	--	--	--	--	0	8	--	53	7	31
Elm	-12,374	-177	--	--	-136	-2,556	-70	-1,004	-4,487	-510	-3,434
Paper birch	25,532	1,718	--	43	15	5,900	86	3,135	3,887	2,955	7,793
Other hardwoods	3,080	--	--	--	--	74	63	8	1,129	135	1,671
Total	472,286	45,026	--	390	627	82,472	5,537	53,894	94,973	45,294	144,073
All species	677,757	89,500	--	823	794	133,768	7,830	80,519	116,683	60,865	186,975

Table 33.--Net annual growth of sawtimber on commercial forest land by species group and ownership class, Michigan, 1979

(In thousand board feet)[1/]

Species group	All owners	Ownership class									
		National Forest	Bureau of Land Mgmt.	Misc. federal	Indian	State	County & municipal	Forest industry	Farmer	Misc. priv.-corp.	Misc. priv.-indiv.
SOFTWOODS											
White pine	108,617	11,804	--	--	--	29,836	1,165	9,132	10,381	13,287	33,012
Red pine	117,205	47,160	--	935	--	36,835	2,875	1,171	6,719	6,838	14,672
Jack pine	104,334	29,044	--	1,554	--	49,493	582	1,691	3,688	3,778	14,504
White spruce	95,051	26,481	--	647	52	18,249	822	14,041	7,884	13,621	13,254
Black spruce	10,896	1,057	--	--	--	5,387	470	4,370	371	-386	-373
Balsam fir	66,895	9,365	--	624	429	9,768	1,668	12,742	8,726	6,466	17,107
Hemlock	63,350	7,145	--	28	240	6,785	486	26,795	4,244	6,500	11,127
Tamarack	5,070	1,523	--	--	--	3,131	34	1,212	471	-2,042	741
Northern white-cedar	105,695	9,326	--	9	20	25,928	407	19,976	13,476	8,701	27,852
Other softwoods	9,741	19	--	--	--	--	--	--	3,346	945	5,431
Total	686,854	142,924	--	3,797	741	185,412	8,509	91,130	59,306	57,708	137,327
HARDWOODS											
Select white oaks	68,022	5,664	--	591	--	10,134	135	79	25,197	5,230	20,992
Select red oaks	186,674	3,704	--	--	30	42,038	2,675	7,321	42,921	17,237	70,748
Other red oaks	36,495	10,883	--	--	--	2,634	23	133	6,014	2,393	14,415
Hickory	15,022	--	--	--	--	1,582	26	--	8,671	57	4,686
Yellow birch	32,273	1,112	--	88	579	1,885	-104	12,463	6,075	5,095	5,080
Hard maple	288,837	25,511	--	36	775	30,795	2,332	72,061	53,872	26,723	76,732
Soft maple	301,091	26,668	--	219	215	50,111	1,660	41,894	55,854	23,892	100,578
Beech	24,013	3,026	--	--	--	823	39	7,766	3,214	3,742	5,403
Ash	109,978	8,405	--	--	48	12,287	3,395	10,266	26,057	9,021	40,499
Balsam poplar	25,884	438	--	--	5	6,559	--	3,408	3,065	3,355	9,054
Cottonwood	9,610	--	--	--	--	320	--	21	6,430	522	2,317
Bigtooth aspen	143,373	12,728	--	--	66	32,947	4,024	2,809	23,792	10,857	56,150
Quaking aspen	250,279	44,321	--	--	127	47,102	5,642	19,094	42,693	19,067	72,233
Basswood	95,669	8,475	--	--	69	20,943	796	9,466	19,484	9,666	26,770
Yellow-poplar	737	--	--	--	--	--	--	--	549	-5	193
Black walnut	2,089	--	--	--	--	--	--	--	380	--	1,709
Black cherry	45,841	5,869	--	--	--	6,039	31	4,590	16,258	1,141	11,913
Butternut	156	--	--	--	--	--	36	--	52	68	--
Elm	-13,924	1,015	--	--	-570	-3,765	-250	1,912	-5,746	-938	-5,582
Paper birch	65,409	8,341	--	32	--	14,858	49	7,933	11,723	6,091	16,382
Other hardwoods	9,990	--	--	--	--	856	1,476	36	3,242	330	4,050
Total	1,697,518	166,160	--	966	1,344	278,148	21,985	201,252	349,797	143,544	534,322
All species	2,384,372	309,084	--	4,763	2,085	463,560	30,494	292,382	409,103	201,252	671,649

[1/] International 1/4-inch rule.

Table 34.--Net annual growth of growing stock on commercial forest land by species group and forest type, Michigan, 1979

(In thousand cubic feet)

Species group	All types	Forest type: Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar
SOFTWOODS								
White pine	19,345	449	1,257	5,735	898	204	533	807
Red pine	44,857	3,130	34,218	751	95	46	298	27
Jack pine	26,700	19,932	2,168	133	24	99	697	--
White spruce	23,053	31	396	723	5,366	3,878	218	932
Black spruce	12,587	310	43	70	1,102	41	8,974	551
Balsam fir	24,608	42	70	104	9,123	187	802	-4,549
Hemlock	10,814	--	134	44	209	3	58	278
Tamarack	161	3	7	11	90	5	429	-2,132
Northern white-cedar	39,369	5	24	212	1,421	276	850	24,934
Other softwoods	3,977	--	144	491	5	68	76	179
Total	205,471	23,902	38,461	8,274	18,333	4,807	12,935	21,027
HARDWOODS								
Select white oaks	12,566	53	209	58	--	--	--	--
Select red oaks	33,886	1,122	284	278	23	--	--	--
Other red oaks	8,388	421	199	--	--	--	--	--
Hickory	2,871	7	--	--	--	--	--	--
Yellow birch	9,329	--	--	10	163	6	15	403
Hard maple	94,457	4	86	148	173	41	26	238
Soft maple	113,426	289	473	883	1,749	186	460	1,521
Beech	6,163	--	3	8	6	1	--	--
Ash	39,045	--	-20	--	320	--	69	1,443
Balsam poplar	4,481	--	2	14	195	10	40	91
Cottonwood	2,500	--	--	--	--	--	--	--
Bigtooth aspen	36,330	119	648	196	-16	2	60	-70
Quaking aspen	52,163	482	721	370	1,171	408	888	601
Basswood	22,318	11	20	14	11	--	--	51
Yellow-poplar	400	--	23	--	--	--	--	--
Black walnut	796	--	3	--	--	--	--	--
Black cherry	16,830	20	117	404	130	61	20	20
Butternut	99	--	--	--	--	--	--	5
Elm	-12,374	-18	--	-9	-229	-19	--	-450
Paper birch	25,532	143	88	243	1,276	70	467	1,169
Other hardwoods	3,080	7	--	--	--	--	--	-7
Total	472,286	2,660	2,856	2,617	4,972	766	2,045	5,015
All species	677,757	26,562	41,317	10,891	23,305	5,573	14,980	26,042

(Table 34 continued on next page)

(Table 34 continued)

Species group	Forest type							
	Tamarack	Oak-hickory	Elm-ash-soft maple	Maple-birch	Aspen	Paper birch	Exotic	Non-stocked
SOFTWOODS								
White pine	43	1,220	503	4,792	2,543	267	86	8
Red pine	7	1,957	91	1,330	2,382	124	374	27
Jack pine	110	1,933	--	457	940	90	20	97
White spruce	53	125	663	4,745	4,994	936	--	-7
Black spruce	285	3	235	17	721	231	--	4
Balsam fir	72	89	1,347	7,481	8,349	1,413	--	78
Hemlock	--	22	604	9,064	309	89	--	--
Tamarack	1,565	--	93	-24	104	4	--	6
Northern white-cedar	352	8	2,611	3,334	4,536	797	4	5
Other softwoods	--	67	27	364	9	--	2,547	--
Total	2,487	5,424	6,174	31,560	24,887	3,951	3,031	218
HARDWOODS								
Select white oaks	--	9,562	747	1,463	458	16	--	--
Select red oaks	--	21,380	369	5,819	4,341	194	73	3
Other red oaks	--	7,069	100	409	180	--	10	--
Hickory	--	1,698	89	1,056	17	4	--	--
Yellow birch	--	27	809	7,324	273	298	1	--
Hard maple	--	577	872	87,337	4,227	717	11	--
Soft maple	3	7,489	20,074	58,646	18,369	3,258	14	12
Beech	--	228	30	5,758	120	9	--	--
Ash	11	1,299	12,541	18,777	4,074	498	3	30
Balsam poplar	13	13	171	303	3,479	143	9	-2
Cottonwood	--	331	1,163	646	360	--	--	--
Bigtooth aspen	--	4,912	232	4,319	25,701	226	--	1
Quaking aspen	32	1,541	1,486	7,236	36,249	863	38	77
Basswood	--	568	871	19,843	749	139	14	27
Yellow-poplar	--	28	11	338	--	--	--	--
Black walnut	--	326	307	160	--	--	--	--
Black cherry	--	2,069	1,078	11,016	1,819	34	18	24
Butternut	--	23	14	57	--	--	--	--
Elm	--	-36	-2,905	-8,051	-805	148	-12	12
Paper birch	40	434	1,160	4,223	9,010	7,199	--	10
Other hardwoods	--	155	1,424	1,398	99	4	--	--
Total	99	59,693	40,643	228,077	108,720	13,750	179	194
All species	2,586	65,117	46,817	259,637	133,607	17,701	3,210	412

Table 35.--Net annual growth of sawtimber on commercial forest land by species group and forest type, Michigan, 1979

(In thousand board feet)[1/]

Species group	All types	Forest type: Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar
SOFTWOODS								
White pine	108,617	1,888	6,531	31,975	6,478	918	2,692	4,936
Red pine	117,205	13,399	76,452	2,998	527	113	831	118
Jack pine	104,334	80,319	7,806	1,331	29	104	1,846	--
White spruce	95,051	121	196	2,504	31,365	6,842	543	2,631
Black spruce	10,896	11	86	492	3,964	532	5,523	13
Balsam fir	66,895	185	617	248	21,380	1,909	186	-11,515
Hemlock	63,350	--	49	959	1,369	21	272	1,797
Tamarack	5,070	--	43	49	1,244	-18	1,667	-1,987
Northern white-cedar	105,695	--	18	96	7,161	383	3,787	60,813
Other softwoods	9,741	--	1,040	1,092	--	1,450	--	--
Total	686,854	95,923	92,838	41,744	73,517	12,254	17,347	56,806
HARDWOODS								
Select white oaks	68,022	153	252	303	--	--	--	--
Select red oaks	186,674	5,063	1,795	1,900	--	--	--	--
Other red oaks	36,495	619	540	--	--	--	--	--
Hickory	15,022	1,365	--	--	--	--	--	--
Yellow birch	32,273	--	--	23	1,562	-1	34	1,876
Hard maple	288,837	--	267	120	245	33	30	573
Soft maple	301,091	80	528	360	8,022	--	120	4,015
Beech	24,013	--	24	--	--	10	--	--
Ash	109,978	--	-127	--	164	--	1,101	2,257
Balsam poplar	25,884	--	9	17	694	-41	23	494
Cottonwood	9,610	--	--	--	--	--	--	--
Bigtooth aspen	143,373	969	1,875	92	-155	13	595	-174
Quaking aspen	250,279	1,052	85	241	10,116	851	2,007	317
Basswood	95,669	21	60	--	38	--	--	205
Yellow-poplar	737	--	--	--	--	--	--	--
Black walnut	2,089	--	--	--	0	--	--	--
Black cherry	45,841	--	189	779	18	48	--	4
Butternut	156	--	--	--	--	--	--	9
Elm	-13,924	--	--	--	38	-137	--	-1,302
Paper birch	65,409	13	84	844	1,536	19	2,774	4,028
Other hardwoods	9,990	--	--	--	--	--	--	-28
Total	1,697,518	9,335	5,581	4,679	22,278	795	6,684	12,274
All species	2,384,372	105,258	98,419	46,423	95,795	13,049	24,031	69,080

(Table 35 continued on next page)

[1/] International 1/4-inch

(Table 35 continued)

Species group	Forest type							
	Tamarack	Oak-hickory	Elm-ash-soft maple	Maple-birch	Aspen	Paper birch	Exotic	Non-stocked
SOFTWOODS								
White pine	558	10,574	3,483	23,034	13,983	1,210	334	23
Red pine	36	7,094	223	2,940	11,819	471	107	77
Jack pine	82	5,572	--	853	5,447	812	77	56
White spruce	--	70	2,456	22,077	22,266	3,983	--	-3
Black spruce	142	--	477	-876	560	-46	--	18
Balsam fir	33	42	2,765	23,974	24,274	2,776	--	21
Hemlock	--	110	2,776	54,468	1,215	314	--	--
Tamarack	2,513	--	193	-17	1,303	29	--	51
Northern white-cedar	1,146	28	6,027	11,662	11,157	3,406	--	11
Other softwoods	--	370	--	2,908	6	--	2,875	--
Total	4,510	23,860	18,400	141,023	92,030	12,955	3,393	254
HARDWOODS								
Select white oaks	--	46,739	2,152	12,836	5,529	58	--	--
Select red oaks	--	112,314	1,351	41,782	20,613	1,797	37	22
Other red oaks	--	29,931	840	1,947	2,618	--	--	--
Hickory	--	10,244	362	2,958	62	31	--	--
Yellow birch	--	24	3,320	25,269	118	40	8	--
Hard maple	--	2,466	859	278,001	4,791	1,419	33	--
Soft maple	--	15,263	80,410	170,495	18,987	2,713	42	56
Beech	--	1,135	35	22,768	40	1	--	--
Ash	--	5,125	35,421	59,607	6,315	95	20	--
Balsam poplar	8	27	1,585	1,496	19,670	1,917	--	-15
Cottonwood	--	578	4,959	2,472	1,601	--	--	--
Bigtooth aspen	--	14,195	2,189	19,609	103,945	220	--	--
Quaking aspen	11	1,246	7,436	58,408	164,791	3,697	--	21
Basswood	--	466	4,847	84,494	3,922	1,390	--	226
Yellow-poplar	--	109	15	613	--	--	--	--
Black walnut	--	1,888	58	143	--	--	--	--
Black cherry	--	6,205	5,217	31,062	2,277	--	42	--
Butternut	--	17	36	94	--	--	--	--
Elm	--	301	-3,272	-8,816	-766	-22	--	52
Paper birch	6	1,364	5,431	12,730	15,804	20,776	--	--
Other hardwoods	--	297	7,054	930	854	883	--	--
Total	25	249,934	160,305	818,898	371,171	35,015	182	362
All species	4,535	273,794	178,705	959,921	463,201	47,970	3,575	616

Table 36.--Net annual growth of growing stock on commercial forest land by forest type and stand-age class, Michigan, 1979

(In thousand cubic feet)

Forest type	All classes	Stand-age class (years)												
		1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Jack pine	26,562	983	2,256	2,592	4,547	8,163	4,160	1,699	1,541	475	66	53	27	--
Red pine	41,317	679	4,554	17,375	9,804	4,478	531	1,296	612	704	378	855	51	--
White pine	10,891	71	303	808	129	1,588	873	1,567	1,426	1,398	1,122	590	626	390
Balsam fir	23,305	1,276	1,872	931	3,715	4,557	4,464	2,053	1,860	970	336	1,066	26	179
White spruce	5,573	282	774	32	2,031	729	675	106	233	289	0	479	--	-57
Black spruce	14,980	1,337	1,314	1,970	3,384	1,743	2,615	1,142	946	168	111	107	98	45
Northern white-cedar	26,042	453	1,221	1,615	2,238	1,823	2,987	4,239	3,365	2,945	1,548	2,140	926	542
Tamarack	2,586	207	185	312	51	319	665	452	127	29	134	80	--	25
Oak-hickory	65,117	3,049	2,234	632	4,202	9,055	13,149	7,000	7,561	6,020	3,810	6,871	1,403	131
Elm-ash-soft maple	46,817	2,649	3,116	3,167	5,041	6,215	5,926	5,162	3,543	3,950	1,902	4,008	1,373	765
Maple-birch	259,637	11,356	10,768	7,383	20,500	48,828	46,807	24,323	17,749	19,632	17,072	23,847	9,202	2,170
Aspen	133,607	14,737	15,115	5,554	18,922	26,872	24,612	11,974	7,745	3,686	2,479	1,643	268	--
Paper birch	17,701	689	492	503	1,373	2,718	6,080	3,367	1,071	388	644	103	234	39
Exotic	3,210	145	617	1,672	408	61	307	--	--	--	--	--	--	--
Nonstocked	412	150	83	22	23	36	86	--	--	12	--	--	--	--
All types	677,757	38,063	44,904	44,568	76,368	117,185	113,937	64,380	47,779	40,666	29,602	41,842	14,234	4,229

Table 37.--Net annual growth of sawtimber on commercial forest land by forest type and stand-age class, Michigan, 1979

(In thousand board feet)[1/]

Forest type	All classes	Stand-age class (years)												
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Jack pine	105,258	2,533	3,046	4,584	23,656	27,595	20,694	11,645	8,884	1,321	1,083	159	58	--
Red pine	98,419	174	4,916	14,536	37,499	19,159	3,198	5,214	3,465	3,789	2,402	3,968	99	--
White pine	46,423	161	1,804	1,274	449	4,538	3,216	6,638	7,737	6,197	6,453	3,311	3,179	1,466
Balsam fir	95,795	2,777	5,952	3,270	10,548	22,302	14,097	9,287	15,353	5,812	1,833	3,076	1,178	310
White spruce	13,049	292	1,330	--	2,369	1,830	771	2,617	567	1,958	--	1,591	--	-276
Black spruce	24,031	1,904	3,440	4,018	2,678	2,367	2,298	3,908	329	--	866	1,061	1,329	-167
Northern white-cedar	69,080	1,927	817	2,090	2,201	3,571	7,276	9,375	4,902	7,615	3,974	11,913	6,343	7,076
Tamarack	4,535	1,013	292	1,174	60	67	294	291	192	35	491	493	--	133
Oak-hickory	273,794	9,783	7,670	1,483	12,366	26,009	41,917	30,107	42,232	36,883	14,164	42,435	8,031	714
Elm-ash-soft maple	178,705	12,179	6,464	6,078	14,275	16,329	28,668	17,888	16,138	22,249	6,995	23,456	4,646	3,340
Maple-birch	959,921	26,700	25,741	16,018	48,138	142,912	136,572	92,243	81,796	116,461	87,253	123,197	48,431	14,459
Aspen	463,201	30,464	19,764	11,285	46,804	91,423	98,728	69,701	42,476	22,899	17,346	11,187	1,124	--
Paper birch	47,970	2,830	522	23	1,898	5,772	18,752	8,069	3,078	1,165	4,601	911	278	71
Exotic	3,575	--	89	164	1,603	660	1,059	--	--	--	--	--	--	--
Nonstocked	616	8	304	--	--	172	82	--	--	50	--	--	--	--
All types	2,384,372	92,745	82,151	65,997	204,544	364,706	377,622	266,983	227,149	226,434	147,461	226,758	74,696	27,126

[1/] International 1/4-inch rule.

Table 38.--Net annual growth of growing stock on commercial forest land by forest type, stand-size class, and basal-area class, Michigan, 1979

(In thousand cubic feet)

Forest type and stand-size class	All classes	Basal area class (square feet per acre)													
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-150	151-180	181+
Jack pine															
Sawtimber	5,762	--	--	99	153	447	738	1,303	1,088	648	505	781	--	--	--
Poletimber	16,587	--	62	259	455	943	1,316	1,552	2,154	1,369	2,650	2,914	2,868	--	45
Sapling & seedling	4,213	29	94	123	628	482	672	589	849	128	130	--	489	--	--
All stands	26,562	29	156	481	1,236	1,872	2,726	3,444	4,091	2,145	3,285	3,695	3,357	--	45
Red pine															
Sawtimber	7,350	--	13	--	288	247	46	429	728	539	455	989	2,008	1,116	492
Poletimber	29,843	--	--	--	88	390	766	1,252	2,558	2,124	1,548	4,615	5,731	6,441	4,330
Sapling & seedling	4,124	25	237	140	176	173	1,184	236	1,310	283	--	300	60	--	--
All stands	41,317	25	250	140	552	810	1,996	1,917	4,596	2,946	2,003	5,904	7,799	7,557	4,822
White pine															
Sawtimber	7,724	--	--	19	220	185	151	393	985	635	837	1,695	498	2,106	--
Poletimber	2,728	--	--	--	--	96	144	312	344	453	68	697	614	--	--
Sapling & seedling	439	11	23	70	33	95	54	153	--	--	--	--	--	--	--
All stands	10,891	11	23	89	253	376	349	858	1,329	1,088	905	2,392	1,112	2,106	--
Balsam fir															
Sawtimber	4,801	--	--	--	--	--	227	125	--	562	923	1,021	1,914	-84	113
Poletimber	14,610	--	--	29	47	392	188	1,215	1,172	971	1,818	4,013	2,798	1,431	536
Sapling & seedling	3,894	8	88	71	614	612	286	885	440	448	245	146	26	25	--
All stands	23,305	8	88	100	661	1,004	701	2,225	1,612	1,981	2,986	5,180	4,738	1,372	649
White spruce															
Sawtimber	1,027	--	--	--	38	62	--	66	87	68	93	205	221	151	36
Poletimber	3,458	--	--	--	--	35	--	419	276	439	184	172	1,696	129	108
Sapling & seedling	1,088	--	42	82	186	36	43	78	131	--	--	490	--	--	--
All stands	5,573	--	42	82	224	133	43	563	494	507	277	867	1,917	280	144
Black spruce															
Sawtimber	350	--	--	--	--	--	32	--	64	121	--	49	84	--	--
Poletimber	9,926	6	--	25	551	234	695	512	278	616	832	4,345	1,235	286	311
Sapling & seedling	4,704	10	286	43	443	634	480	987	193	183	855	403	187	--	--
All stands	14,980	16	286	68	994	868	1,207	1,499	535	920	1,687	4,797	1,506	286	311
Northern white-cedar															
Sawtimber	3,066	--	--	--	49	44	63	184	259	--	418	1,344	952	679	-926
Poletimber	18,456	--	--	--	172	20	266	293	451	383	959	2,215	5,457	3,991	4,249
Sapling & seedling	4,520	113	11	22	46	180	68	551	510	89	506	748	1,150	522	4
All stands	26,042	113	11	22	267	244	397	1,028	1,220	472	1,883	4,307	7,559	5,192	3,327

(Table 38 continued on next page)

(Table 38 continued)

Forest type and stand-size class	All classes	Basal area class (square feet per acre)													
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-150	151-180	181+
Tamarack															
Sawtimber	333	--	--	19	3	25	--	--	202	--	--	--	84	--	--
Poletimber	1,297	--	--	--	179	137	120	171	222	222	127	119	--	--	--
Sapling & seedling	956	9	40	150	127	73	24	112	194	203	10	--	14	--	--
All stands	2,586	9	40	169	309	235	144	283	618	425	137	119	98	--	--
Oak-hickory															
Sawtimber	26,185	6	--	83	191	997	1,519	2,169	3,303	3,293	2,919	5,865	4,963	877	--
Poletimber	33,273	--	10	--	100	1,607	2,908	3,648	3,948	4,115	5,141	6,505	3,828	1,044	419
Sapling & seedling	5,659	37	430	229	1,344	1,491	1,065	894	45	20	51	53	--	--	--
All stands	65,117	43	440	312	1,635	4,095	5,492	6,711	7,296	7,428	8,111	12,423	8,791	1,921	419
Elm-ash-soft maple															
Sawtimber	17,670	--	--	69	305	672	629	1,095	2,516	1,349	855	3,390	4,503	1,771	516
Poletimber	22,204	--	217	109	690	1,803	237	2,217	2,730	1,033	5,562	2,779	2,712	1,799	316
Sapling & seedling	6,943	25	175	392	1,046	1,340	1,398	907	717	78	526	279	60	--	--
All stands	46,817	25	392	570	2,041	3,815	2,264	4,219	5,963	2,460	6,943	6,448	7,275	3,570	832
Maple-birch															
Sawtimber	95,744	--	42	--	287	885	1,081	4,456	8,295	6,205	13,175	23,046	26,271	9,716	2,285
Poletimber	138,076	--	51	197	1,540	1,624	2,134	8,565	12,301	10,652	17,980	33,007	37,011	12,504	510
Sapling & seedling	25,817	97	1,172	832	3,160	3,230	3,314	5,157	2,967	3,014	940	1,305	629	--	--
All stands	259,637	97	1,265	1,029	4,987	5,739	6,529	18,178	23,563	19,871	32,095	57,358	63,911	22,220	2,795
Aspen															
Sawtimber	22,463	--	124	17	348	817	645	1,424	2,525	1,765	2,748	3,531	5,269	2,299	951
Poletimber	79,037	--	56	131	1,807	3,495	4,346	7,481	8,403	7,528	11,903	12,521	13,790	6,256	1,320
Sapling & seedling	32,107	196	1,520	2,826	4,022	7,168	3,569	4,549	2,032	1,084	3,075	781	1,285	--	--
All stands	133,607	196	1,700	2,974	6,177	11,480	8,560	13,454	12,960	10,377	17,726	16,833	20,344	8,555	2,271
Paper birch															
Sawtimber	1,713	--	--	--	35	--	37	210	--	52	353	487	529	--	10
Poletimber	14,499	--	--	--	149	528	535	813	1,195	945	1,859	2,019	5,112	1,167	177
Sapling & seedling	1,489	4	8	45	225	263	54	165	130	127	325	143	--	--	--
All stands	17,701	4	8	45	409	791	626	1,188	1,325	1,124	2,537	2,649	5,641	1,167	187
Exotic															
Sawtimber	252	--	--	--	--	--	--	--	--	--	--	252	--	--	--
Poletimber	2,021	--	--	--	--	--	158	--	55	197	401	713	375	122	--
Sapling & seedling	937	--	20	202	114	13	--	66	344	--	165	--	13	--	--
All stands	3,210	--	20	202	114	13	158	66	399	197	566	965	388	122	--
Nonstocked	412	124	210	2	6	--	-2	24	48	--	--	--	--	--	--
All types															
Sawtimber	194,440	6	179	306	1,917	4,381	5,168	11,854	20,052	15,237	23,281	42,655	47,296	18,631	3,477
Poletimber	386,015	6	396	750	5,778	11,304	13,813	28,450	36,087	31,047	51,032	76,634	83,227	35,170	12,321
Sapling & seedling	96,890	564	4,146	5,227	12,164	15,790	12,211	15,329	9,862	5,657	6,828	4,648	3,913	547	4
Nonstocked	412	124	210	2	6	--	-2	24	48	--	--	--	--	--	--
All stands	677,757	700	4,931	6,285	19,865	31,475	31,190	55,657	66,049	51,941	81,141	123,937	134,436	54,348	15,802

Table 39.--Net annual growth of sawtimber on commercial forest land by forest type, stand-size class, and basal-area class, Michigan, 1979

(In thousand board feet)[1/]

Forest type and stand-size class	All classes	Basal area class (square feet per acre)													
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-150	151-180	181+
Jack pine															
Sawtimber	40,466	--	--	359	444	1,762	6,751	8,176	7,088	5,174	4,725	5,987	--	--	--
Poletimber	58,347	--	921	285	1,776	10,032	3,402	6,360	6,909	3,983	12,628	5,418	6,150	--	483
Sapling & seedling	6,445	59	233	102	1,514	2,301	387	982	802	65	--	--	--	--	--
All stands	105,258	59	1,154	746	3,734	14,095	10,540	15,518	14,799	9,222	17,353	11,405	6,150	--	483
Red pine															
Sawtimber	42,370	--	74	--	1,774	1,170	226	1,901	4,394	2,462	2,861	6,178	13,102	5,914	2,314
Poletimber	52,397	--	--	--	244	456	2,995	731	5,946	1,920	200	8,772	7,333	14,985	8,815
Sapling & seedling	3,652	136	19	639	--	96	2,182	248	--	332	--	--	--	--	--
All stands	98,419	136	93	639	2,018	1,722	5,403	2,880	10,340	4,714	3,061	14,950	20,435	20,899	11,129
White pine															
Sawtimber	38,288	--	--	410	525	1,023	331	2,084	4,325	3,780	4,461	8,116	1,959	11,274	--
Poletimber	5,925	--	--	--	--	409	273	113	426	963	124	2,838	779	--	--
Sapling & seedling	2,210	65	123	339	164	155	315	1,049	--	--	--	--	--	--	--
All stands	46,423	65	123	749	689	1,587	919	3,246	4,751	4,743	4,585	10,954	2,738	11,274	--
Balsam fir															
Sawtimber	31,986	--	--	--	--	--	1,215	172	--	3,274	2,838	13,983	8,562	496	1,446
Poletimber	52,031	--	--	33	84	591	101	5,913	4,259	1,461	5,584	12,439	12,617	6,636	2,313
Sapling & seedling	11,778	10	96	1,070	2,121	3,257	1,015	2,554	255	1,005	237	70	88	--	--
All stands	95,795	10	96	1,103	2,205	3,848	2,331	8,639	4,514	5,740	8,659	26,492	21,267	7,132	3,759
White spruce															
Sawtimber	4,699	--	--	--	108	288	--	288	283	131	88	641	1,270	401	1,201
Poletimber	6,730	--	--	--	--	65	--	73	660	1,609	462	1,005	1,189	1,556	111
Sapling & seedling	1,620	--	66	113	85	169	75	148	964	--	--	--	--	--	--
All stands	13,049	--	66	113	193	522	75	509	1,907	1,740	550	1,646	2,459	1,957	1,312
Black spruce															
Sawtimber	1,892	--	--	--	--	--	104	--	129	147	--	151	1,361	--	--
Poletimber	13,948	--	--	466	1,302	120	303	1,045	911	119	2,193	2,868	3,232	1,369	20
Sapling & seedling	8,191	-5	2,493	--	865	1,672	726	414	575	628	749	26	48	--	--
All stands	24,031	-5	2,493	466	2,167	1,792	1,133	1,459	1,615	894	2,942	3,045	4,641	1,369	20
Northern white-cedar															
Sawtimber	27,615	--	--	--	181	72	279	710	988	--	2,740	7,173	5,674	7,133	2,665
Poletimber	35,800	--	--	--	51	16	46	958	804	67	2,722	4,754	9,118	8,325	8,939
Sapling & seedling	5,665	837	29	55	27	425	19	1,023	586	578	370	1,159	240	300	17
All stands	69,080	837	29	55	259	513	344	2,691	2,378	645	5,832	13,086	15,032	15,758	11,621

(Table 39 continued on next page)

[1/] International 1/4-inch rule.

(Table 39 continued)

Forest type and stand-size class	All classes	Basal area class (square feet per acre)													
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-150	151-180	181+
Tamarack															
Sawtimber	1,267	--	--	109	26	133	--	--	613	--	--	--	386	--	--
Poletimber	775	--	--	--	35	61	110	157	167	163	79	3	--	--	--
Sapling & seedling	2,493	--	912	101	759	--	68	139	5	95	--	--	414	--	--
All stands	4,535	--	912	210	820	194	178	296	785	258	79	3	800	--	--
Oak-hickory															
Sawtimber	148,569	32	--	1,008	1,168	4,111	9,901	9,290	16,249	25,003	14,860	26,583	35,205	5,159	--
Poletimber	107,659	--	16	--	25	2,726	6,941	11,816	15,109	12,218	13,753	26,883	13,186	3,785	1,201
Sapling & seedling	17,566	127	936	310	3,363	5,949	2,129	4,271	148	33	225	75	--	--	--
All stands	273,794	159	952	1,318	4,556	12,786	18,971	25,377	31,506	37,254	28,838	53,541	48,391	8,944	1,201
Elm-ash-soft maple															
Sawtimber	99,061	--	--	1,934	3,331	6,050	4,807	8,299	12,244	5,751	5,649	18,434	21,474	10,298	790
Poletimber	58,776	--	122	104	3,625	2,288	1,491	6,212	6,319	1,965	15,507	7,001	7,571	5,034	1,537
Sapling & seedling	20,868	323	234	891	2,642	5,585	5,605	572	2,806	-262	1,958	44	470	--	--
All stands	178,705	323	356	2,929	9,598	13,923	11,903	15,083	21,369	7,454	23,114	25,479	29,515	15,332	2,327
Maple-birch															
Sawtimber	515,311	--	567	--	1,063	5,858	4,832	17,499	41,168	25,704	76,718	123,977	148,737	59,345	9,843
Poletimber	385,353	--	15	198	1,283	5,113	6,816	20,755	25,108	26,250	44,898	90,005	116,914	45,942	2,056
Sapling & seedling	59,257	230	1,343	4,244	8,060	7,013	6,294	11,488	5,031	7,029	3,765	4,201	559	--	--
All stands	959,921	230	1,925	4,442	10,406	17,984	17,942	49,742	71,307	58,983	125,381	218,183	266,210	105,287	11,899
Aspen															
Sawtimber	152,662	--	73	82	913	5,636	3,731	14,467	20,232	12,379	18,594	20,441	35,641	11,664	8,809
Poletimber	254,157	--	8	599	4,304	4,940	6,623	25,061	21,220	27,303	35,520	44,724	53,987	18,033	11,835
Sapling & seedling	56,382	52	4,081	4,649	10,422	13,803	6,640	7,708	5,318	1,408	965	998	338	--	--
All stands	463,201	52	4,162	5,330	15,639	24,379	16,994	47,236	46,770	41,090	55,079	66,163	89,966	29,697	20,644
Paper birch															
Sawtimber	8,316	--	--	--	141	--	81	247	--	119	717	2,453	4,514	--	44
Poletimber	37,712	--	--	--	94	3,407	1,478	1,477	2,658	245	1,574	3,765	15,745	7,176	93
Sapling & seedling	1,942	29	--	82	43	285	153	1,188	61	93	--	8	--	--	--
All stands	47,970	29	--	82	278	3,692	1,712	2,912	2,719	457	2,291	6,226	20,259	7,176	137
Exotic															
Sawtimber	980	--	--	--	--	--	--	--	--	--	--	980	--	--	--
Poletimber	2,469	--	--	--	--	--	--	--	79	--	57	1,572	42	719	--
Sapling & seedling	126	--	--	--	--	--	--	--	80	--	46	--	--	--	--
All stands	3,575	--	--	--	--	--	--	--	159	--	103	2,552	42	719	--
Nonstocked	616	32	608	38	5	--	-41	--	-26	--	--	--	--	--	--
All types															
Sawtimber	1,113,482	32	714	3,902	9,674	26,103	32,258	63,133	107,713	83,924	134,251	235,097	277,885	111,684	27,112
Poletimber	1,072,079	--	1,082	1,685	12,823	30,224	30,579	80,671	90,575	78,266	135,301	212,047	247,863	113,560	37,403
Sapling & seedling	198,195	1,863	10,565	12,595	30,065	40,710	25,608	31,784	16,631	11,004	8,315	6,581	2,157	300	17
Nonstocked	616	32	608	38	5	--	-41	--	-26	--	--	--	--	--	--
All stands	2,384,372	1,927	12,969	18,220	52,567	97,037	88,404	175,588	214,893	173,194	277,867	453,725	527,905	225,544	64,532

Table 40.--Timber removals[1/] from growing stock on commercial forest land by species group and Forest Survey Unit, Michigan 1979

(In thousand cubic feet)

Species group	All Units	Forest Survey Unit			
		Eastern Upper Peninsula	Western Upper Peninsula	Northern Lower Peninsula	Southern Lower Peninsula
SOFTWOODS					
White pine	5,097	1,691	2,409	872	125
Red pine	7,798	1,422	1,945	3,105	1,326
Jack pine	16,192	5,230	2,889	7,999	74
White spruce	2,194	997	1,100	87	10
Black spruce	2,441	1,432	921	88	--
Balsam fir	8,931	4,273	3,816	842	--
Hemlock	6,633	2,554	3,868	185	26
Tamarack	772	151	79	438	104
Northern white-cedar	6,088	3,396	976	1,633	83
Other softwoods	221	--	--	--	221
Total	56,367	21,146	18,003	15,249	1,969
HARDWOODS					
Select white oaks	8,984	17	23	3,006	5,938
Select red oaks	20,599	151	1,417	11,720	7,311
Other red oaks	6,073	--	--	3,541	2,532
Hickory	647	--	--	15	632
Yellow birch	4,894	1,616	3,224	40	14
Hard maple	32,271	9,179	14,549	5,310	3,233
Soft maple	23,982	3,189	6,075	8,839	5,879
Beech	5,840	3,444	101	1,539	756
Ash	5,614	313	547	2,090	2,664
Balsam poplar	2,370	926	651	784	9
Cottonwood	1,291	--	--	454	837
Bigtooth aspen	31,390	1,509	3,792	25,206	883
Quaking aspen	51,805	8,658	22,510	20,023	614
Basswood	4,794	482	1,153	1,980	1,179
Black walnut	205	--	--	--	205
Elm	6,997	1,289	3,351	1,731	626
Paper birch	7,734	2,471	2,574	2,579	110
Other hardwoods[2/]	2,739	108	332	418	1,881
Total	218,229	33,352	60,299	89,275	35,303
All species	274,596	54,498	78,302	104,524	37,272

[1/] Removals in 1979 are trend-level removals.

[2/] Includes black cherry, butternut, and yellow-poplar.

Table 41.--Timber removals[1] from sawtimber on commercial forest land by species group and Forest Survey Unit, Michigan, 1979

(In thousand board feet)[2]

Species group	All Units	Forest Survey Unit: Eastern Upper Peninsula	Western Upper Peninsula	Northern Lower Peninsula	Southern Lower Peninsula
SOFTWOODS					
White pine	24,939	7,518	12,010	4,749	662
Red pine	27,365	5,571	7,770	10,636	3,388
Jack pine	40,291	11,894	7,680	20,583	134
White spruce	9,166	4,617	4,233	316	--
Black spruce	2,830	1,761	956	113	--
Balsam fir	23,301	10,525	9,512	3,264	--
Hemlock	23,663	9,043	13,748	805	67
Tamarack	766	426	147	185	8
Northern white-cedar	12,847	7,071	2,130	3,627	19
Other softwoods	25	--	--	--	25
Total	165,193	58,426	58,186	44,278	4,303
HARDWOODS					
Select white oaks	39,366	8	94	9,022	30,242
Select red oaks	79,627	611	4,832	38,084	36,100
Other red oaks	24,026	--	--	11,073	12,953
Hickory	3,229	--	--	93	3,136
Yellow birch	19,913	7,114	12,551	188	60
Hard maple	148,076	42,700	62,127	25,517	17,732
Soft maple	73,409	9,039	9,885	26,621	27,864
Beech	29,468	17,080	519	7,967	3,902
Ash	23,877	1,024	1,507	8,784	12,562
Balsam poplar	5,483	1,645	1,108	2,701	29
Cottonwood	6,535	--	--	2,332	4,203
Bigtooth aspen	80,876	2,868	11,389	63,600	3,019
Quaking aspen	143,925	18,022	60,776	63,275	1,852
Basswood	22,633	2,404	4,466	9,760	6,003
Black walnut	1,134	--	--	--	1,134
Elm	23,142	4,917	10,987	5,975	1,263
Paper birch	16,538	6,071	4,842	5,208	417
Other hardwoods[3]	9,063	377	539	806	7,341
Total	750,320	113,880	185,622	281,006	169,812
All species	915,513	172,306	243,808	325,284	174,115

[1] Removals in 1979 are trend-level removals.

[2] International 1/4-inch rule.

[3] Includes black cherry, butternut, and yellow-poplar.

Table 42.--Timber removals[1] from growing stock and sawtimber on commercial forest land by species group, Michigan, 1965 and 1979

Species group	Growing stock		Sawtimber	
	1965[2]	1979	1965[2]	1979
	Thousand cubic feet		Thousand board feet[3]	
SOFTWOODS				
White pine	2,972	5,097	15,757	24,939
Red pine	2,497	7,798	9,569	27,365
Jack pine	17,771	16,192	46,882	40,291
White spruce	2,847	2,194	14,292	9,166
Black spruce	3,450	2,441	8,015	2,830
Balsam fir	7,493	8,931	23,750	23,301
Hemlock	11,095	6,633	58,487	23,663
Tamarack	1,380	772	2,459	766
Northern white-cedar	9,284	6,088	12,814	12,847
Other softwoods	190	221	118	25
Total	58,979	56,367	192,143	165,193
HARDWOODS				
Select white oaks	6,293	8,984	29,566	39,366
Select red oaks	13,306	20,599	55,367	79,627
Other red oaks	3,679	6,073	13,956	24,026
Hickory	760	647	3,771	3,229
Yellow birch	7,569	4,894	42,335	19,913
Hard maple	27,305	32,271	142,103	148,076
Soft maple	12,585	23,982	47,954	73,409
Beech	5,550	5,840	32,126	29,468
Ash	3,538	5,614	14,284	23,877
Balsam poplar	1,297	2,370	7,208	5,483
Cottonwood	1,249	1,291	7,076	6,535
Bigtooth aspen	26,072	31,390	86,887	80,876
Quaking aspen	46,868	51,805	121,708	143,925
Basswood	3,685	4,794	20,305	22,633
Black walnut	382	205	2,364	1,134
Elm	11,859	6,997	65,595	23,142
Paper birch	4,873	7,734	14,735	16,538
Other hardwoods[4]	3,744	2,739	16,342	9,063
Total	180,614	218,229	723,682	750,320
All species	239,593	274,596	915,825	915,513

[1] Removals in 1979 are trend-level removals.

[2] Figures have been adjusted from those published after the 1966 survey to conform to 1979 volumes because of changes in survey definitions and procedures.

[3] International 1/4-inch rule.

[4] Includes black cherry.

Table 43.--Timber removals[1/] from growing stock and sawtimber on commercial forest land by item and species category, Michigan, 1979

Item	Growing stock						Sawtimber					
	All species	Pine	Other softwoods	Aspen	Hard maple	Other hardwoods	All species	Pine	Other softwoods	Aspen	Hard maple	Other hardwoods
	Thousand cubic feet						Thousand board feet[2/]					
ROUNDWOOD PRODUCTS												
Pulpwood	104,681	19,088	13,595	42,833	4,003	25,162	197,015	44,432	36,169	72,275	10,614	33,525
Saw logs	93,845	7,543	3,386	21,913	16,275	44,728	513,306	43,215	18,591	106,807	98,853	245,840
Fuelwood	8,324	16	23	553	1,617	6,115	27,425	103	96	1,816	5,311	20,099
Posts	2,602	--	2,591	--	--	11	2,740	--	2,674	--	--	66
Veneer logs	4,796	4	--	2,187	1,200	1,405	35,030	28	--	15,983	8,748	10,271
Poles	78	78	--	--	--	--	313	313	--	--	--	--
Other[3/]	8,722	229	605	6,569	30	1,289	15,648	715	1,971	11,265	193	1,504
Total	223,048	26,958	20,200	74,055	23,125	78,710	791,477	88,806	59,501	208,146	123,719	311,305
LOGGING RESIDUE	16,758	1,067	1,281	4,042	2,848	7,520	34,052	1,169	3,101	4,166	7,725	17,891
OTHER REMOVALS	34,790	1,062	5,799	5,098	6,298	16,533	89,984	2,620	9,996	12,489	16,632	48,247
ALL REMOVALS	274,596	29,087	27,280	83,195	32,271	102,763	915,513	92,595	72,598	224,801	148,076	377,443

[1/] Removals in 1979 are trend-level removals.

[2/] International 1/4-inch rule.

[3/] Includes charcoal wood, shingle bolts, cabin logs, particleboard bolts, piling, etc.

[4/] Less than 500 cubic feet.

Table 44.--Net annual growth and removals[1/] of growing stock on commercial forest land by species group, Michigan, 1979

(In thousand cubic feet)

Species group	Net annual growth	Annual timber removals
SOFTWOODS		
White pine	19,345	5,097
Red pine	44,857	7,798
Jack pine	26,700	16,192
White spruce	23,053	2,194
Black spruce	12,587	2,441
Balsam fir	24,608	8,931
Hemlock	10,814	6,633
Tamarack	161	772
Northern white-cedar	39,369	6,088
Other softwoods	3,977	221
Total	205,471	56,367
HARDWOODS		
Select white oaks	12,566	8,984
Select red oaks	33,886	20,599
Other red oaks	8,388	6,073
Hickory	2,871	647
Yellow birch	9,329	4,894
Hard maple	94,457	32,271
Soft maple	113,426	23,982
Beech	6,163	5,840
Ash	39,045	5,614
Balsam poplar	4,481	2,370
Cottonwood	2,500	1,291
Bigtooth aspen	36,330	31,390
Quaking aspen	52,163	51,805
Basswood	22,318	4,794
Black walnut	796	205
Elm	-12,374	6,997
Paper birch	25,532	7,734
Other hardwoods[2/]	20,409	2,739
Total	472,286	218,229
All species	677,757	274,596

[1/] Removals in 1979 are trend-level removals.

[2/] Includes black cherry, butternut, and yellow-poplar.

Table 45.--Net annual growth and removals[1/] of sawtimber on commercial forest land by species group, Michigan, 1979

(In thousand board feet)[2/]

Species group	Net annual growth	Annual timber removals
SOFTWOODS		
White pine	108,617	24,939
Red pine	117,205	27,365
Jack pine	104,334	40,291
White spruce	95,051	9,166
Black spruce	10,896	2,830
Balsam fir	66,895	23,301
Hemlock	63,350	23,663
Tamarack	5,070	766
Northern white-cedar	105,695	12,847
Other softwoods	9,741	25
Total	686,854	165,193
HARDWOODS		
Select white oaks	68,022	39,366
Select red oaks	186,674	79,627
Other red oaks	36,495	24,026
Hickory	15,022	3,229
Yellow birch	32,273	19,913
Hard maple	288,837	148,076
Soft maple	301,091	73,409
Beech	24,013	29,468
Ash	109,978	23,877
Balsam poplar	25,884	5,483
Cottonwood	9,610	6,535
Bigtooth aspen	143,373	80,876
Quaking aspen	250,279	143,925
Basswood	95,669	22,633
Black walnut	2,089	1,134
Elm	-13,924	23,142
Paper birch	65,409	16,538
Other hardwoods[3/]	56,724	9,063
Total	1,697,518	750,320
All species	2,384,372	915,513

[1/] Removals in 1979 are trend-level removals.

[2/] International 1/4-inch rule.

[3/] Includes black cherry, butternut, and yellow-poplar.

Table 46.--Net annual growth and removals[1/] of growing stock on commercial forest land by ownership class and softwoods and hardwoods, Michigan, 1979

(In thousand cubic feet)

Ownership class	Net annual growth			Annual timber removals		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
National Forest	89,500	44,474	45,026	27,203	9,655	17,548
Bureau of Land Mgmt.	--	--	--	--	--	--
Miscellaneous federal	823	433	390	138	103	35
Indian	794	167	627	162	11	151
State	133,768	51,296	82,472	33,896	10,325	23,571
County and municipal	7,830	2,293	5,537	1,024	214	810
Forest industry	80,519	26,625	53,894	30,900	7,039	23,861
Farmer and other[2/]	364,523	80,183	284,340	181,273	29,020	152,253
All owners	677,757	205,471	472,286	274,596	56,367	218,229

[1/] Removals in 1979 are trend-level removals.

[2/] Includes miscellaneous private-corporation and miscellaneous private-indivdual.

Table 47.--Net annual growth and removals[1/] of sawtimber on commercial forest land by ownership class and softwoods and hardwoods, Michigan, 1979

(In thousand board feet)[2/]

Ownership class	Net annual growth			Annual timber removals		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
National Forest	309,084	142,924	166,160	62,708	25,161	37,547
Bureau of Land Mgmt.	--	--	--	--	--	--
Miscellaneous federal	4,763	3,797	966	324	244	80
Indian	2,085	741	1,344	315	22	293
State	463,560	185,412	278,148	89,409	28,220	61,189
County and municipal	30,494	8,509	21,985	2,392	456	1,936
Forest industry	292,382	91,130	201,252	103,095	22,971	80,124
Farmer and other[3/]	1,282,004	254,341	1,027,663	657,270	88,119	569,151
All owners	2,384,372	686,854	1,697,518	915,513	165,193	750,320

[1/] Removals in 1979 are trend-level removals.

[2/] International 1/4-inch rule.

[3/] Includes miscellaneous private-corporation and miscellaneous private-individual.

Table 48.--Annual mortality of growing stock on commercial forest land by softwoods and hardwoods, Michigan, 1965 and 1979

(In million cubic feet)

Species	1/1965	1979
Softwoods	29.3	41.1
Hardwoods	80.3	117.1
Total	109.6	158.2

1/Figures have been adjusted from those published after the 1966 survey to conform to 1979 volumes because of changes in survey definitions and procedures.

Table 49.--Annual mortality of growing stock on commercial forest land by species group and cause, Michigan, 1979

(In thousand cubic feet)

Species group	All causes	Cause						
		Insects	Disease	Fire	Animals	Weather	Suppression	Unknown and other
SOFTWOODS								
White pine	888	5	309	9	--	164	17	384
Red pine	72	--	38	--	--	2	7	25
Jack pine	2,430	55	388	--	80	137	31	1,739
White spruce	1,799	163	153	--	--	415	9	1,059
Black spruce	2,899	460	584	18	10	287	10	1,530
Balsam fir	23,959	3,496	4,125	--	55	3,710	69	12,504
Hemlock	636	12	141	--	--	59	3	421
Tamarack	4,515	108	761	86	142	60	--	3,358
Northern white-cedar	3,708	15	900	--	40	1,038	31	1,684
Other softwoods	179	--	--	--	--	--	--	179
Total	41,085	4,314	7,399	113	327	5,872	177	22,883
HARDWOODS								
Select white oaks	976	35	210	--	--	--	--	731
Select red oaks	5,237	137	633	--	1	177	68	4,221
Other red oaks	1,239	--	245	--	--	--	--	994
Hickory	147	--	--	--	--	39	--	108
Yellow birch	3,389	--	1,351	--	--	158	--	1,880
Hard maple	11,723	--	4,218	--	216	2,484	210	4,595
Soft maple	4,614	--	1,032	--	36	1,074	--	2,472
Beech	2,735	--	--	--	--	1,098	--	1,637
Ash	4,053	263	873	--	--	708	73	2,136
Balsam poplar	5,053	--	1,875	--	--	534	--	2,644
Cottonwood	149	--	30	--	--	1	26	92
Bigtooth aspen	12,045	--	6,060	--	--	941	95	4,949
Quaking aspen	32,447	43	15,076	--	506	4,798	69	11,955
Basswood	2,374	--	767	--	--	259	--	1,348
Yellow-poplar	46	--	--	--	--	--	--	46
Black walnut	101	--	--	--	--	--	--	101
Black cherry	489	--	32	--	--	59	--	398
Butternut	10	--	--	--	--	--	--	10
Elm	26,427	94	20,540	--	9	32	--	5,752
Paper birch	3,218	--	1,073	--	15	188	15	1,927
Other hardwoods	594	--	185	--	--	287	--	122
Total	117,066	572	54,200	--	783	12,837	556	48,118
All species	158,151	4,886	61,599	113	1,110	18,709	733	71,001

Table 50.--Annual mortality of sawtimber on commercial forest land by species group and cause, Michigan, 1979

(In thousand board feet)[1/]

Species group	All causes	Cause						
		Insects	Disease	Fire	Animals	Weather	Suppression	Unknown and other
SOFTWOODS								
White pine	3,714	25	1,291	--	--	732	--	1,666
Red pine	--	--	--	--	--	--	--	--
Jack pine	6,317	111	1,634	--	301	149	206	3,916
White spruce	6,842	765	735	--	--	2,008	--	3,334
Black spruce	6,901	1,669	2,067	--	--	138	104	2,923
Balsam fir	38,545	3,823	7,079	--	198	8,716	--	18,729
Hemlock	2,856	62	674	--	--	277	--	1,843
Tamarack	7,194	197	1,650	--	--	--	--	5,347
Northern white-cedar	8,312	61	2,130	--	44	1,999	--	4,078
Other softwoods	114	--	--	--	--	--	--	114
Total	80,795	6,713	17,260	--	543	14,019	310	41,950
HARDWOODS								
Select white oaks	1,455	--	1,432	--	--	1	--	22
Select red oaks	16,788	--	3,061	--	4	208	--	13,515
Other red oaks	3,087	--	1,146	--	--	--	--	1,941
Hickory	237	--	--	--	--	11	--	226
Yellow birch	12,783	--	5,077	--	--	1,090	--	6,616
Hard maple	28,195	--	11,686	--	--	6,426	--	10,083
Soft maple	9,222	--	1,694	--	--	2,392	--	5,136
Beech	9,820	--	2	--	--	4,412	--	5,406
Ash	7,743	--	3,172	--	--	3,081	--	1,490
Balsam poplar	16,604	--	6,484	--	--	2,569	--	7,551
Cottonwood	329	--	13	--	--	--	--	316
Bigtooth aspen	25,400	--	13,006	--	--	3,255	--	9,139
Quaking aspen	62,885	--	23,684	--	1,638	14,102	--	23,461
Basswood	6,205	--	2,651	--	--	796	--	2,758
Yellow-poplar	187	--	--	--	--	--	--	187
Black walnut	305	--	--	--	--	--	--	305
Black cherry	449	--	30	--	--	172	--	247
Butternut	28	--	--	--	--	--	--	28
Elm	52,701	193	39,570	--	--	29	--	12,909
Paper birch	4,013	--	1,584	--	--	681	--	1,748
Other hardwoods	915	--	422	--	--	491	--	2
Total	259,351	193	114,714	--	1,642	39,716	--	103,086
All species	340,146	6,906	131,974	--	2,185	53,735	310	145,036

[1/] International 1/4-inch rule.

Table 51.--Annual mortality of growing stock and sawtimber on commercial forest land by ownership class and softwoods and hardwoods, Michigan, 1979

Ownership class	Growing stock			Sawtimber		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	Thousand cubic feet			Thousand board feet[1/]		
National Forest	18,939	5,597	13,342	39,090	12,741	26,349
Bureau of Land Management	--	--	--	--	--	--
Miscellaneous federal	361	48	313	679	106	573
Indian	220	36	184	770	89	681
State	31,065	10,760	20,305	62,254	19,631	42,623
County and municipal	1,392	241	1,151	2,686	469	2,217
Forest industry	18,666	6,596	12,070	46,882	12,756	34,126
Farmer	29,861	4,771	25,090	59,611	7,038	52,573
Misc. private-corp.	14,768	4,525	10,243	38,041	12,342	25,699
Misc. private-indiv.	42,879	8,511	34,368	90,133	15,623	74,510
All owners	158,151	41,085	117,066	340,146	80,795	259,351

[1/] International 1/4-inch rule.

Table 52.--Output of timber products by product, softwoods and hardwoods, and source of material, Michigan, 1978

Product	Standard units	Total		Roundwood products				Plant byproducts	
				Growing stock		Nongrowing stock			
		No. of units	Thousand cubic feet	No. of units	Thousand cubic feet	No. of units	Thousand cubic feet	No. of units	Thousand cubic feet
PULPWOOD									
Softwood	[1] Standard	480,169	37,891	414,188	32,683	48,804	3,851	17,177	1,357
Hardwood	cords	1,194,803	94,281	912,547	71,998	152,373	12,023	129,883	10,260
Total		1,674,972	132,172	1,326,735	104,681	201,177	15,874	147,060	11,617
SAW LOGS									
Softwood	[2] Thousand	65,120	11,290	63,042	10,929	2,078	361	--	--
Hardwood	board feet	498,203	85,709	481,987	82,916	16,216	2,793	--	--
Total		563,323	96,999	545,029	93,845	18,294	3,154	--	--
VENEER LOGS									
Softwood	[2] Thousand	28	4	28	4	--	--	--	--
Hardwood	board feet	35,002	4,792	35,002	4,792	--	--	--	--
Total		35,030	4,796	35,030	4,796	--	--	--	--
FUELWOOD									
Softwood	[1] Standard	23,398	1,583	717	39	2,601	138	20,080	1,406
Hardwood	cords	602,283	42,061	118,740	8,285	320,451	22,359	163,092	11,417
Total		625,681	43,644	119,457	8,324	323,052	22,497	183,172	12,823
POSTS									
Softwood	Thousand	2,777	2,846	2,528	2,591	249	255	--	--
Hardwood	pieces	7	11	7	11	--	--	--	--
Total		2,784	2,857	2,535	2,602	249	255	--	--
POLES									
Softwood	Pieces	9,196	78	9,196	78	--	--	--	--
Hardwood		--	--	--	--	--	--	--	--
Total		9,196	78	9,196	78	--	--	--	--
OTHER[3]									
Softwood	Thousand	1,300	1,300	834	834	52	52	414	414
Hardwood	cubic feet	20,894	20,894	7,888	7,888	1,007	1,007	11,999	11,999
Total		22,194	22,194	8,722	8,722	1,059	1,059	12,413	12,413
ALL PRODUCTS									
Softwood	Thousand	--	54,992	--	47,158	--	4,657	--	3,177
Hardwood	cubic feet	--	247,748	--	175,890	--	38,182	--	33,676
Total		--	302,740	--	223,048	--	42,839	--	36,853

[1] Rough-wood, 128 cubic foot basis.

[2] International 1/4-inch rule.

[3] Other (industrial production) includes cabin logs, charcoal wood, particleboard bolts, shingle bolts, pilings, etc.

Table 53.--Output of roundwood products by product, softwoods and hardwoods, and source of material, Michigan, 1978

(In thousand cubic feet)

Product and species group	All sources	Growing-stock trees			Rough and rotten trees	Salvable dead trees	Other sources
		Total	Sawtimber	Poletimber			
INDUSTRIAL PRODUCTS							
Saw logs							
Softwood	11,290	10,929	10,762	167	6	139	216
Hardwood	85,709	82,916	77,663	5,253	806	361	1,626
Subtotal	96,999	93,845	88,425	5,420	812	500	1,842
Veneer logs and bolts							
Softwood	4	4	4	--	--	--	--
Hardwood	4,792	4,792	4,792	--	--	--	--
Subtotal	4,796	4,796	4,796	--	--	--	--
Pulpwood							
Softwood	36,534	32,683	20,847	11,836	703	943	2,205
Hardwood	84,021	71,998	29,938	42,060	5,873	957	5,193
Subtotal	120,555	104,681	50,785	53,896	6,576	1,900	7,398
Cooperage							
Softwood	--	--	--	--	--	--	--
Hardwood	--	--	--	--	--	--	--
Subtotal	--	--	--	--	--	--	--
Piling							
Softwood	9	9	9	--	--	--	--
Hardwood	--	--	--	--	--	--	--
Subtotal	9	9	9	--	--	--	--
Poles							
Softwood	78	78	64	14	--	--	--
Hardwood	--	--	--	--	--	--	--
Subtotal	78	78	64	14	--	--	--
Mine timbers (Round)							
Softwood	14	11	9	2	--	3	--
Hardwood	30	30	30	--	--	--	--
Subtotal	44	41	39	2	--	3	--
Posts (Round and split)							
Softwood	2,846	2,591	687	1,904	30	--	225
Hardwood	11	11	11	--	--	--	--
Subtotal	2,857	2,602	698	1,904	30	--	225
Other							
Softwood	863	814	497	317	--	7	42
Hardwood	8,865	7,858	3,135	4,723	288	87	632
Subtotal	9,728	8,672	3,632	5,040	288	94	674
All industrial products							
Softwood	51,638	47,119	32,879	14,240	739	1,092	2,688
Hardwood	183,428	167,605	115,569	52,036	6,967	1,405	7,451
Total	235,066	214,724	148,448	66,276	7,706	2,497	10,139
FUELWOOD							
Softwood	177	39	24	15	5	2	131
Hardwood	30,644	8,285	4,817	3,468	1,735	143	20,481
Total	30,821	8,324	4,841	3,483	1,740	145	20,612
ALL PRODUCTS							
Softwood	51,815	47,158	32,903	14,255	744	1,094	2,819
Hardwood	214,072	175,890	120,386	55,504	8,702	1,548	27,932
Total	265,887	223,048	153,289	69,759	9,446	2,642	30,751

Table 54.--Timber products from roundwood by species group and product, Michigan, 1978

Species group	All products	Pulpwood		Saw logs		Veneer logs	
	Thousand cubic feet	Cords	Thousand cubic feet	Thousand board feet[1/]	Thousand cubic feet	Thousand board feet[1/]	Thousand cubic feet
SOFTWOODS							
White pine	4,611	10,836	850	22,276	3,726	1	--
Red pine	8,175	74,037	5,842	13,231	2,205	27	4
Jack pine	17,288	192,007	15,167	9,821	1,840	--	--
White spruce	1,865	20,603	1,623	886	163	--	--
Black spruce	1,981	21,892	1,726	884	163	--	--
Balsam fir	8,126	87,342	6,893	3,396	641	--	--
Hemlock	5,346	48,413	3,822	8,907	1,493	--	--
Tamarack	176	1,750	133	221	42	--	--
Northern white-cedar	4,247	6,112	478	5,498	1,017	--	--
Other softwoods	--	--	--	--	--	--	--
Total	51,815	462,992	36,534	65,120	11,290	28	4
HARDWOODS							
Select white oaks	8,912	18,773	1,463	29,105	5,096	615	84
Select red oaks	24,248	77,059	6,077	77,635	13,622	2,205	302
Other red oaks	4,516	8,182	645	15,860	2,784	411	56
Hickory	712	--	--	1,435	232	43	4
Yellow birch	3,664	22,395	1,766	8,087	1,357	2,839	389
Hard maple	30,547	82,203	6,486	104,075	16,843	8,748	1,200
Soft maple	21,097	120,135	9,478	47,465	8,321	594	80
Beech	4,690	10,587	832	17,987	3,008	1,148	158
Ash	5,629	11,072	865	18,664	3,253	178	24
Balsam poplar	2,308	25,297	1,994	1,450	252	--	--
Cottonwood	1,182	--	--	5,848	1,018	226	31
Bigtooth aspen	28,263	181,505	14,336	52,115	9,158	2,468	338
Quaking aspen	51,846	404,103	31,919	74,963	13,177	13,515	1,849
Basswood	3,852	4,276	336	19,364	3,379	521	74
Black walnut	236	--	--	855	139	173	22
Elm	9,083	25,975	2,053	12,481	2,186	241	33
Paper birch	8,352	67,324	5,304	6,646	1,164	1,004	138
Other hardwoods[2/]	4,935	6,034	467	4,168	720	73	10
Total	214,072	1,064,920	84,021	498,203	85,709	35,002	4,792
All species	265,887	1,527,912	120,555	563,323	96,999	35,030	4,796

(Table 54 continued on next page)

[1/] International 1/4-inch rule.

[2/] Includes black cherry, butternut, and yellow-poplar.

(Table 54 continued)

Species group	Fuelwood		Posts		Poles		Other products
	Cords	Thousand cubic feet	Thousand pieces	Thousand cubic feet	Pieces	Thousand cubic feet	Thousand cubic feet
SOFTWOODS							
White pine	644	35	--	--	--	--	--
Red pine	313	10	--	--	8,606	73	41
Jack pine	753	39	--	--	590	5	237
White spruce	19	--	61	61	--	--	18
Black spruce	24	1	73	73	--	--	18
Balsam fir	49	1	542	555	--	--	36
Hemlock	530	31	--	--	--	--	--
Tamarack	52	1	--	--	--	--	--
Northern white-cedar	934	59	2,101	2,157	--	--	536
Other softwoods	--	--	--	--	--	--	--
Total	3,318	177	2,777	2,846	9,196	78	886
HARDWOODS							
Select white oaks	32,416	2,267	--	--	--	--	2
Select red oaks	55,899	3,896	--	--	--	--	351
Other red oaks	14,185	991	--	--	--	--	40
Hickory	6,858	476	--	--	--	--	--
Yellow birch	2,235	152	--	--	--	--	--
Hard maple	85,682	5,988	--	--	--	--	30
Soft maple	37,016	2,586	--	--	--	--	632
Beech	9,887	689	--	--	--	--	3
Ash	21,333	1,487	--	--	--	--	--
Balsam poplar	884	62	--	--	--	--	--
Cottonwood	1,903	133	--	--	--	--	--
Bigtooth aspen	14,041	979	--	--	--	--	3,452
Quaking aspen	15,228	1,064	--	--	--	--	3,837
Basswood	968	63	--	--	--	--	--
Black walnut	1,074	75	--	--	--	--	--
Elm	68,873	4,811	--	--	--	--	--
Paper birch	17,269	1,198	--	--	--	--	548
Other hardwoods	53,440	3,727	7	11	--	--	--
Total	439,191	30,644	7	11	--	--	8,895
All species	442,509	30,821	2,784	2,857	9,196	78	9,781

Table 55.--Volume of primary plant residue by use and type of residue, Michigan, 1978

(In thousand cubic feet)

Use	Wood residue							
	Total		Coarse[1]		Fine[2]		Bark[3]	
	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood
Fiber products[4]	1,194.8	14,899.7	1,147.9	14,584.1	46.9	315.6	30.5	579.9
Charcoal	--	--	--	--	--	--	--	3.0
Industrial fuel	702.7	4,478.6	167.7	767.7	535.0	3,710.9	696.8	3,650.4
Domestic fuel	701.7	6,937.4	699.9	6,859.5	1.8	77.9	232.5	3,596.3
Miscellaneous[5]	414.4	7,358.8	19.8	406.6	394.6	6,952.2	186.5	3,941.3
Not used[6]	773.2	5,323.9	356.2	1,303.0	417.0	4,020.9	613.6	3,957.6
Total	3,786.8	38,998.4	2,391.5	23,920.9	1,395.3	15,077.5	1,759.9	15,728.5

[1] Suitable for chipping such as slabs, edgings, veneer cores, etc.

[2] Not suitable for chipping such as sawdust, veneer clippings, etc.

[3] Does not include bark disposal at pulpmills.

[4] For manufacture of pulp, hardboard, or roofing felt.

[5] Livestock bedding, mulch, small dimension, and specialty items.

[6] Includes residue burned as waste.

Table 56.--All live shrub[1/] biomass yields on commercial forest land by shrub species group and forest type, Michigan, 1980

(In pounds per acre)

Shrub species group	Forest type														
	Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak-hickory	Elm-ash-soft maple	Maple-birch	Aspen	Paper birch	Exotic	Non-stocked
TALL SHRUBS															
Balsam fir	4	27	125	587	66	181	317	145	10	72	71	125	285	--	--
Tamarack	--	--	--	14	13	10	8	81	--	2	--	1	15	--	--
White spruce	--	--	--	48	43	--	13	--	2	4	4	5	35	--	--
Black spruce	17	7	3	71	--	476	46	167	--	4	--	2	1	--	--
Jack pine	199	6	--	--	--	--	--	--	26	--	--	3	--	--	4
Red pine	8	27	--	--	--	--	--	--	3	--	1	--	--	--	--
White pine	13	22	122	7	--	1	--	6	34	--	2	6	14	--	--
Scotch pine	--	--	--	--	--	--	--	--	--	--	--	--	--	94	--
Northern white-cedar	--	--	--	306	7	9	315	22	--	15	16	15	27	--	--
Hemlock	--	--	--	8	--	--	--	--	--	5	11	--	1	--	--
Boxelder	--	--	--	--	--	--	--	--	--	2	--	--	--	--	--
Striped maple	--	--	--	--	--	--	--	--	--	--	5	1	3	--	--
Red maple	11	48	55	37	153	29	56	29	85	109	102	143	53	3	--
Silver maple	--	--	--	--	--	--	--	--	1	10	--	3	--	--	--
Sugar maple	--	15	68	29	55	52	9	--	8	25	480	39	22	--	--
Mountain maple	--	--	--	103	86	--	32	2	--	76	32	21	145	--	--
Red alder	--	--	7	--	--	--	--	--	--	--	--	3	--	--	--
Green alder	34	--	--	--	--	40	--	--	3	--	--	1	44	--	--
Speckled alder	71	24	118	644	260	1,703	433	2,607	13	607	35	134	283	--	369
Yellow birch	--	--	--	5	--	--	--	--	--	5	15	3	--	16	--
Paper birch	1	--	1	10	31	--	6	--	--	8	6	7	12	--	--
Swamp birch	--	--	--	--	--	11	--	--	--	--	--	--	--	--	--
American hornbeam	--	30	--	--	--	--	--	--	5	11	6	1	1	--	--
Dogwood	1	1	93	68	15	49	110	38	45	219	27	126	200	1	36
Flowering dogwood	--	--	--	--	--	3	--	--	4	--	1	--	--	--	--
Hawthorn	6	21	--	--	--	--	--	--	8	3	2	3	--	--	46
Beech	--	6	--	--	--	--	--	--	1	2	24	2	--	--	--
White ash	--	2	--	--	1	--	--	--	22	21	20	25	16	1	--
Black ash	--	--	--	28	1	--	96	1	--	155	9	21	7	--	--
Green ash	--	--	--	--	--	--	10	--	1	45	4	11	2	--	--
Black alder	--	--	--	--	--	--	53	8	--	32	3	1	--	--	--
Mountain holly	--	--	--	--	--	4	--	--	--	16	--	--	1	--	--
Spice bush	--	--	--	--	--	--	--	--	--	26	8	--	--	--	--
Apple	--	--	--	--	--	--	--	--	3	--	1	--	--	--	--
Eastern hophornbeam	--	--	8	--	--	--	--	--	14	--	45	21	1	21	--
Balsam poplar	--	--	--	31	18	--	20	--	--	6	1	18	10	--	--
Bigtooth aspen	1	10	--	--	--	--	--	--	7	--	2	62	53	17	--
Quaking aspen	4	27	1	3	--	4	7	5	7	21	27	213	53	20	--
Pincherry	12	--	--	--	8	--	--	--	5	1	1	3	--	--	1
Black cherry	27	36	30	21	16	8	2	--	149	66	51	68	18	40	1
Chokecherry	6	2	5	5	83	6	4	17	13	17	9	32	7	4	1
Sandcherry	1	--	--	--	--	--	--	--	--	--	--	--	--	--	16
Pawpaw	--	--	--	--	--	--	--	--	--	--	1	--	--	--	--
White oak	6	1	13	--	--	--	--	--	67	1	4	5	--	1	--
Northern pin oak	--	--	--	1	--	--	--	--	--	--	--	--	--	--	--
Northern red oak	62	35	4	--	--	--	--	--	164	4	13	32	13	12	2
Black oak	8	--	--	--	--	--	--	--	25	--	--	2	--	--	--
Sweet gale	--	--	--	34	--	--	4	--	--	22	--	--	--	--	--

(Table 56 continued on next page)

(Table 56 continued)

Shrub species group	Forest type														
	Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak-hickory	Elm-ash-soft maple	Maple-birch	Aspen	Paper birch	Exotic	Non-stocked
Mountain ash	--	--	--	--	--	6	9	--	--	2	2	2	--	--	--
Witch hazel	--	--	18	10	7	11	--	--	38	11	11	45	12	--	--
Juneberry	25	11	109	25	82	12	18	391	18	18	16	49	38	1	7
Hazel	--	20	106	88	111	--	162	45	21	86	113	115	48	--	--
Prickly ash	--	--	--	--	--	--	--	--	64	12	3	--	--	--	--
Alder buckthorn	--	--	--	--	--	--	4	--	--	3	--	--	--	--	--
Leatherwood	--	--	--	--	--	--	--	--	--	--	2	1	--	--	--
Viburnum	34	27	--	239	--	98	47	137	189	192	21	99	56	--	--
Elder	--	6	--	--	--	--	2	--	2	18	11	2	--	--	1
Sumac	--	38	--	--	--	--	1	--	10	7	7	18	--	4	4
Buffaloberry	--	--	--	3	--	--	--	--	--	--	--	1	--	--	--
Buttonbush	--	--	--	2	--	--	--	--	--	--	--	--	--	--	--
Willow	57	23	1	105	246	4	43	408	1	89	9	61	69	41	20
Sassafras	--	2	--	--	--	--	--	--	32	1	6	2	--	--	--
American basswood	--	--	--	--	--	--	--	--	1	4	10	2	1	--	--
American elm	12	--	--	2	--	--	--	--	4	56	15	4	78	1	--
Slippery elm	--	--	--	--	--	--	--	--	6	2	1	--	--	--	--
Rock elm	--	--	--	--	--	--	--	--	6	11	--	--	--	--	--
Total	620	474	887	2,534	1,302	2,717	1,827	4,109	1,117	2,124	1,266	1,559	1,624	277	508
LOW SHRUBS															
Common juniper	--	--	10	--	--	--	--	--	--	--	--	--	--	--	--
Yew	--	--	--	4	1	1	2	2	--	--	3	--	--	--	--
Holly	--	--	--	--	--	--	2	--	--	1	--	--	--	--	--
Virginia creeper	--	--	--	--	--	--	--	--	--	1	--	--	1	--	--
Spirea	--	--	--	--	--	--	--	2	--	7	--	--	1	--	1
Labrador tea	13	--	23	41	12	218	9	15	--	41	--	--	--	--	--
Leatherleaf	50	--	151	67	--	158	1	321	9	19	--	17	66	--	--
Bog laurel	2	--	--	--	--	6	1	1	--	1	--	--	--	--	--
Sweetfern	48	13	1	--	5	1	--	1	18	--	2	6	--	5	7
Gooseberry-currant	--	--	--	4	--	--	2	3	1	8	--	2	1	--	26
Chokeberry	--	--	--	--	--	--	--	--	--	--	--	--	1	--	--
Raspberry-blackberry	8	31	38	26	5	9	9	29	25	22	29	39	42	102	69
Rose	--	--	--	2	--	1	--	--	2	2	1	--	--	--	--
Black huckleberry	4	--	--	--	--	--	--	--	2	--	--	--	--	--	--
Bilberry-blueberry	459	157	56	32	13	130	11	41	133	10	11	38	12	--	35
Bush honeysuckle	--	4	4	3	6	--	--	3	1	1	--	2	2	--	--
Honeysuckle	--	7	1	15	8	3	5	4	3	3	5	7	4	--	--
Snowberry	--	--	--	2	1	--	--	--	--	--	--	--	--	--	--
Shrubby cinquefoil	--	--	--	--	--	--	1	--	--	--	--	--	--	--	--
St. John's wort	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bearberry	7	1	--	--	--	2	1	--	--	1	--	--	--	--	--
Greenbriar	--	--	--	--	--	--	--	--	4	--	--	--	--	--	--
Bog rosemary	--	--	--	--	--	4	--	2	--	--	--	1	--	--	--
Grape	--	--	--	--	--	--	--	--	--	3	--	--	1	--	--
Total	591	213	284	196	51	533	44	424	198	120	51	112	131	107	139
All shrubs	1,211	687	1,171	2,730	1,353	3,250	1,871	4,533	1,315	2,244	1,317	1,671	1,755	384	647
Number of plots[2/]	188	107	62	90	101	115	246	28	435	325	1,883	916	108	30	37

[1/] Trees under 1.0-inch d.b.h. are also included. Low shrub species that averaged less than 1.0 pound per acre are not included.

[2/] Number of plots by forest type from which average yields were derived.

Table 57.--All live tree biomass yields on commercial forest land by species group and forest type, Michigan, 1980

(In pounds per acre)

Species group	Forest type														
	Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak-hickory	Elm-ash-soft maple	Maple-birch	Aspen	Paper birch	Exotic	Non-stocked
SOFTWOODS															
White pine	1,355	3,798	58,275	3,116	4,760	2,544	2,172	1,000	1,497	952	1,515	1,316	1,487	1,330	436
Red pine	6,001	72,119	9,585	526	1,367	1,079	120	141	1,654	152	335	1,279	1,018	6,407	297
Jack pine	60,033	9,261	2,017	155	901	3,562	--	419	2,587	21	221	787	702	1,465	403
White spruce	45	333	2,908	12,051	40,173	745	2,261	47	74	733	928	1,465	2,421	410	11
Black spruce	1,265	314	2,471	4,486	2,074	36,702	6,103	6,460	19	403	151	402	653	--	385
Balsam fir	107	652	6,782	41,314	12,220	6,344	15,197	3,692	121	3,849	3,581	5,868	10,739	--	145
Hemlock	--	210	982	1,517	157	430	1,271	--	60	1,638	6,963	370	1,105	--	4
Tamarack	19	34	242	963	543	3,707	3,949	42,978	4	449	36	175	522	--	224
Northern white-cedar	8	169	1,045	8,044	8,755	5,381	68,426	5,480	15	4,565	1,669	2,432	6,684	62	72
Other softwoods	--	540	3,333	10	2,918	11	155	--	111	34	201	37	--	68,786	35
Total	68,833	87,430	87,640	72,182	73,868	60,505	99,654	60,217	6,142	12,796	15,600	14,131	25,331	78,460	2,012
HARDWOODS															
Select white oaks	408	1,547	2,260	--	--	--	--	--	29,727	2,164	1,290	873	256	570	--
Select red oaks	4,906	2,752	4,286	84	--	--	--	--	46,814	1,068	4,031	4,301	2,590	2,032	92
Other red oaks	1,864	2,220	--	--	--	--	--	--	15,920	309	282	281	--	595	--
Hickory	39	87	--	--	--	--	--	--	4,356	284	759	16	47	--	--
Yellow birch	--	--	287	2,877	412	496	1,815	--	81	3,086	8,834	380	1,067	137	--
Hard maple	81	667	2,409	1,767	1,639	179	573	--	1,096	1,944	52,558	2,917	6,220	1,399	358
Soft maple	1,092	2,260	6,761	8,384	3,933	2,028	4,758	853	8,563	35,934	21,587	9,520	12,829	383	316
Beech	--	81	449	44	287	--	--	--	272	254	6,375	275	489	--	15
Ash	--	106	217	1,517	145	394	4,491	307	1,730	22,512	6,033	1,942	2,562	88	408
Balsam poplar	--	11	145	1,757	2,091	347	2,131	629	25	1,101	244	4,059	1,444	1,316	132
Cottonwood	--	--	--	--	--	--	--	--	308	2,342	309	274	--	--	--
Bigtooth aspen	576	1,970	1,576	359	163	288	374	--	5,788	537	2,386	16,310	2,945	1,324	203
Quaking aspen	1,857	3,549	6,956	9,619	17,267	4,752	2,643	1,286	1,731	4,226	5,224	32,421	9,503	3,857	556
Basswood	55	82	69	47	68	--	142	--	511	1,722	8,003	582	1,221	364	--
Yellow-poplar	--	35	--	--	--	--	--	--	98	99	175	--	--	--	--
Black walnut	--	30	--	--	--	--	--	--	1,106	232	91	--	--	--	--
Black cherry	214	711	781	880	1,225	124	68	--	2,750	1,491	3,908	1,227	425	1,375	1,300
Butternut	39	--	--	--	--	--	25	--	122	107	26	--	--	--	--
Elm	36	--	139	876	390	75	278	--	560	5,856	3,864	816	393	124	548
Paper birch	464	808	7,164	8,098	3,251	2,959	9,226	1,631	855	2,967	2,566	6,382	56,478	--	261
Other hardwoods	19	73	--	1	203	--	38	--	1,181	3,236	985	149	52	775	--
Noncommercial species	26	102	11	134	21	258	162	--	820	1,107	2,310	524	773	168	688
Total	11,676	17,091	33,510	36,444	31,095	11,900	26,724	4,706	124,414	92,578	131,840	83,249	99,294	14,507	4,877
All species	80,509	104,521	121,150	108,626	104,963	72,405	126,378	64,923	130,556	105,374	147,440	97,380	124,625	92,967	6,889
Number of plots[1/]	346	226	102	336	52	244	651	64	616	563	2,928	1,529	190	37	89

[1/] Number of plots by forest type from which average yields were derived.

Table 58.--All live tree biomass on commercial forest land by species group and forest type, Michigan, 1980

(In thousand green tons)

Species group	All types	Forest type							
		Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack
SOFTWOODS									
White pine	20,468	567	1,246	6,238	990	238	662	1,275	57
Red pine	33,042	2,511	23,651	1,026	167	68	281	70	8
Jack pine	33,964	25,114	3,038	216	49	45	927	--	24
White spruce	14,150	19	109	311	3,828	2,011	194	1,327	3
Black spruce	17,515	529	103	265	1,425	104	9,554	3,581	371
Balsam fir	51,104	45	214	726	13,126	612	1,651	8,917	212
Hemlock	24,731	--	69	105	482	8	112	746	--
Tamarack	6,954	8	11	26	306	27	965	2,317	2,466
Northern white-cedar	58,567	3	55	112	2,556	438	1,401	40,153	315
Other softwoods	4,544	--	177	357	3	146	3	91	--
Total	265,039	28,796	28,673	9,382	22,932	3,697	15,750	58,477	3,456
HARDWOODS									
Select white oaks	34,208	171	507	242	--	--	--	--	--
Select red oaks	65,860	2,053	902	459	27	--	--	--	--
Other red oaks	17,197	780	728	--	--	--	--	--	--
Hickory	6,447	16	29	--	--	--	--	--	--
Yellow birch	32,067	--	--	31	913	21	129	1,065	--
Hard maple	170,281	34	219	258	562	82	47	336	--
Soft maple	124,063	457	741	723	2,664	197	528	2,792	49
Beech	20,513	--	26	48	14	14	--	--	--
Ash	41,988	--	35	23	482	7	102	2,635	18
Balsam poplar	10,808	--	4	15	558	105	90	1,250	36
Cottonwood	3,236	--	--	--	--	--	--	--	--
Bigtooth aspen	42,645	241	646	169	114	8	75	221	--
Quaking aspen	86,951	777	1,164	745	3,056	864	1,237	1,551	74
Basswood	27,394	23	27	7	15	3	--	83	--
Yellow-poplar	699	--	12	--	--	--	--	--	--
Black walnut	1,423	--	10	--	--	--	--	--	--
Black cherry	18,504	89	232	84	280	61	32	40	--
Butternut	289	16	--	--	--	--	--	15	--
Elm	18,188	15	--	15	277	20	20	163	--
Paper birch	42,268	194	265	767	2,573	163	770	5,414	94
Other hardwoods	6,560	8	24	--	--	10	--	22	--
Noncommercial species	9,861	11	34	1	43	1	67	95	--
Total	781,450	4,885	5,605	3,587	11,578	1,556	3,097	15,682	271
All species	1,046,489	33,681	34,278	12,969	34,510	5,253	18,847	74,159	3,727

(Table 58 continued on next page)

(Table 58 continued)

Species group	Forest type						
	Oak-hickory	Elm-ash-soft maple	Maple-birch	Aspen	Paper birch	Exotic	Non-stocked
SOFTWOODS							
White pine	1,328	631	4,621	2,241	279	57	38
Red pine	1,467	101	1,020	2,179	190	277	26
Jack pine	2,294	14	673	1,340	132	63	35
White spruce	66	486	2,829	2,494	454	18	1
Black spruce	16	267	460	685	122	--	33
Balsam fir	108	2,553	10,920	9,995	2,013	--	12
Hemlock	53	1,086	21,233	630	207	--	--
Tamarack	4	298	110	299	98	--	19
Northern white-cedar	13	3,027	5,091	4,142	1,252	3	6
Other softwoods	98	23	611	64	--	2,968	3
Total	5,447	8,486	47,568	24,069	4,747	3,386	173
HARDWOODS							
Select white oaks	26,361	1,435	3,933	1,486	48	25	--
Select red oaks	41,513	708	12,291	7,326	485	88	8
Other red oaks	14,118	205	861	479	--	26	--
Hickory	3,863	189	2,314	27	9	--	--
Yellow birch	72	2,046	26,936	648	200	6	--
Hard maple	972	1,289	160,258	4,968	1,165	60	31
Soft maple	7,594	23,831	65,824	16,215	2,404	17	27
Beech	241	168	19,440	469	92	--	1
Ash	1,534	14,929	18,396	3,307	480	4	36
Balsam poplar	23	730	744	6,914	271	57	11
Cottonwood	273	1,554	942	467	--	--	--
Bigtooth aspen	5,133	356	7,275	27,781	552	57	17
Quaking aspen	1,535	2,803	15,928	55,222	1,781	166	48
Basswood	453	1,142	24,404	992	229	16	--
Yellow-poplar	87	66	534	--	--	--	--
Black walnut	980	154	279	--	--	--	--
Black cherry	2,439	989	11,917	2,090	80	59	112
Butternut	109	71	78	--	--	--	--
Elm	497	3,884	11,781	1,390	74	5	47
Paper birch	758	1,968	7,826	10,871	10,583	--	22
Other hardwoods	1,047	2,147	3,005	254	10	33	--
Noncommercial species	727	734	7,043	893	145	7	60
Total	110,329	61,398	402,009	141,799	18,608	626	420
All species	115,776	69,884	449,577	165,868	23,355	4,012	593

Table 59.--All live tree biomass by species group and tree biomass component, Michigan, 1980

Species group	All components	Biomass component				
		1- to 5-inch trees	Growing stock		Cull	
			Boles	Tops and limbs	Boles	Tops and limbs
	Thousand green tons					
SOFTWOODS						
White pine	20,468	2,040	12,189	5,518	429	292
Red pine	33,042	6,003	18,274	8,463	186	116
Jack pine	33,964	6,053	18,447	8,324	692	448
White spruce	14,150	2,227	7,919	3,748	156	100
Black spruce	17,515	8,014	6,388	3,003	61	49
Balsam fir	51,104	21,194	19,971	9,251	393	295
Hemlock	24,731	1,754	14,402	6,586	1,218	771
Tamarack	6,954	2,558	2,773	1,362	132	129
Northern white-cedar	58,567	21,279	21,530	10,454	2,924	2,380
Other softwoods	4,544	2,104	1,449	648	214	129
Total	265,039	73,226	123,342	57,357	6,405	4,709
HARDWOODS						
Select white oaks	34,208	2,583	20,271	9,435	1,215	704
Select red oaks	65,860	2,837	41,210	18,692	1,947	1,174
Other red oaks	17,197	771	10,466	4,716	783	461
Hickory	6,447	583	3,852	1,832	116	64
Yellow birch	32,067	3,088	15,100	7,259	3,749	2,871
Hard maple	170,281	30,610	87,477	40,694	7,030	4,470
Soft maple	124,063	23,313	62,142	29,706	5,358	3,544
Beech	20,513	1,720	10,289	4,991	2,116	1,397
Ash	41,988	11,176	19,857	9,048	1,169	738
Balsam poplar	10,808	1,494	5,947	2,809	325	233
Cottonwood	3,236	168	2,002	981	40	45
Bigtooth aspen	42,645	5,268	23,767	11,033	1,525	1,052
Quaking aspen	86,951	13,951	43,874	20,772	4,877	3,477
Basswood	27,394	1,730	16,888	7,433	827	516
Yellow-poplar	699	35	456	208	--	--
Black walnut	1,423	42	905	422	36	18
Black cherry	18,504	3,337	8,737	3,938	1,577	915
Butternut	289	83	104	48	34	20
Elm	18,188	4,187	8,690	4,085	782	444
Paper birch	42,268	5,613	22,910	10,888	1,753	1,104
Other hardwoods	6,560	1,796	2,605	1,260	541	358
Noncommercial species	9,861	6,101	--	--	2,458	1,302
Total	781,450	120,486	407,549	190,250	38,258	24,907
All species	1,046,489	193,712	530,891	247,607	44,663	29,616

(Table 59 continued on next page)

(Table 59 continued)

Species group	All components	Biomass component				
		1- to 5-inch trees	Growing stock		Cull	
			Boles	Tops and limbs	Boles	Tops and limbs
	Thousand cubic feet					
SOFTWOODS						
White pine	1,131,068	112,887	673,572	304,890	23,641	16,078
Red pine	1,610,038	291,070	891,315	412,806	9,130	5,717
Jack pine	1,427,846	251,957	776,430	350,438	29,733	19,288
White spruce	802,888	126,161	449,503	212,725	8,841	5,658
Black spruce	1,071,885	489,401	391,697	184,126	3,713	2,948
Balsam fir	2,332,210	967,759	910,689	421,854	18,200	13,708
Hemlock	1,044,298	73,020	607,468	277,886	52,486	33,438
Tamarack	304,032	112,436	120,639	59,273	5,878	5,806
Northern white-cedar	4,002,623	1,449,989	1,479,501	718,407	196,208	158,518
Other softwoods	217,390	100,379	69,386	31,050	10,346	6,229
Total	13,944,278	3,975,059	6,370,200	2,973,455	358,176	267,388
HARDWOODS						
Select white oaks	1,207,352	88,689	716,249	333,379	43,673	25,362
Select red oaks	2,301,853	97,392	1,439,554	653,131	69,560	42,216
Other red oaks	594,169	26,107	361,188	162,815	27,715	16,344
Hickory	223,930	19,741	134,129	63,766	4,036	2,258
Yellow birch	1,205,190	114,358	564,043	271,235	144,311	111,243
Hard maple	6,456,637	1,151,820	3,316,965	1,543,052	271,480	173,320
Soft maple	5,371,313	1,005,950	2,689,305	1,285,742	234,606	155,710
Beech	801,391	66,863	400,899	194,466	83,711	55,452
Ash	1,738,454	453,626	827,394	377,093	49,025	31,316
Balsam poplar	548,734	75,524	301,969	142,647	16,635	11,959
Cottonwood	137,982	7,140	85,295	41,807	1,759	1,981
Bigtooth aspen	2,041,960	250,260	1,138,168	528,443	73,997	51,092
Quaking aspen	4,151,373	662,709	2,093,648	991,308	235,514	168,194
Basswood	1,363,727	85,636	840,652	369,993	41,478	25,968
Yellow-poplar	36,947	1,833	24,127	10,987	--	--
Black walnut	53,010	1,541	33,739	15,720	1,336	674
Black cherry	838,502	149,496	395,937	178,499	72,326	42,244
Butternut	13,082	3,728	4,660	2,191	1,577	926
Elm	714,324	162,761	341,942	160,732	31,100	17,789
Paper birch	1,758,968	233,624	952,433	452,713	73,686	46,512
Other hardwoods	275,322	74,810	109,190	52,829	23,139	15,354
Noncommercial species	414,445	253,942	--	--	104,892	55,611
Total	32,248,665	4,987,550	16,771,486	7,832,548	1,605,556	1,051,525
All species	46,192,943	8,962,609	23,141,686	10,806,003	1,963,732	1,318,913

Table 60.--Removals[1/], net annual growth, and inventory of growing stock on commercial forest land, Michigan, 1980, and low removals option projections[2/] to 2010

(In million cubic feet)

Year	Removals			Growth			Inventory		
	All species	Soft-woods	Hard-woods	All species	Soft-woods	Hard-woods	All species	Soft-woods	Hard-woods
1980	274.6	56.4	218.2	677.8	205.5	472.3	19,103.8	5,355.6	13,748.2
1990	284.0	57.8	226.2	852.0	227.7	624.3	24,122.8	6,982.0	17,140.8
2000	371.1	83.5	287.6	838.9	227.9	611.0	29,498.0	8,588.3	20,909.7
2010	456.0	109.5	346.5	674.2	214.7	459.5	33,167.9	9,863.8	23,304.1

[1/] Timber removals includes volume "lost" due to land clearing, flooding, thinning, or changes in land use, in addition to timber cut and used.

[2/] Based on the following assumptions: (a) that the overall removals rate will be lower than that for the high removals option; (b) that the percent of annual change for removals will be as shown in Table 5 (in text); (c) that the total area of commercial forest land will decline from 17.5 million acres in 1980 to 17.2 million acres in 2010; (d) that radial growth will decline in relation to the increase of basal area per acre of trees; (e) that the intensity of forest management will continue at the rate indicated by recent trends; (f) that the volume of "other" removals will drop during the period as more of these trees are utilized for products.

Table 61.--Removals[1], net annual growth, and inventory of growing stock on commercial forest land, Michigan, 1980, and high removals option projections[2] to 2010

(In million cubic feet)

Year	Removals			Growth			Inventory		
	All species	Soft-woods	Hard-woods	All species	Soft-woods	Hard-woods	All species	Soft-woods	Hard-woods
1980	274.6	56.4	218.2	677.8	205.5	472.3	19,103.8	5,355.6	13,748.2
1990	357.2	84.9	272.3	845.6	225.6	620.0	23,719.9	6,852.2	16,867.7
2000	494.8	141.4	353.4	819.8	220.4	599.4	28,014.7	7,999.2	20,015.5
2010	637.7	196.7	441.0	638.5	198.6	439.9	29,941.3	8,460.8	21,480.5

[1]Timber removals includes volume "lost" due to land clearing, flooding, thinning, or changes in land use, in addition to timber cut and used.

[2]Based on the following assumptions: (a) that the overall removals rate will be higher than that for the low removals option; (b) that the percent of annual change for removals will be as shown in Table 5 (in text); (c) that the total area of commercial forest land will decline from 17.5 million acres in 1980 to 17.2 million acres in 2010; (d) that radial growth will decline in relation to the increase of basal area per acre of trees; (e) that the intensity of forest management will continue at the rate indicated by recent trends; (f) that the volume of "other" removals will drop during the period as more of these trees are utilized for products.

Table 62.--Sampling errors[1] for estimates smaller than the Unit totals of volume, net growth, removals, and area of commercial forest land, Michigan, 1980

Sampling error	Commercial forest area	Growing stock			Sawtimber		
		Inventory	Growth	Removals	Inventory	Growth	Removals
Percent	Thousand acres	Million cubic feet			Million board feet[2]		
1	1,898.8	9,415.2	731.7	14,102.5	55,754.1	7,199.6	63,265.7
2	474.7	2,353.8	182.9	3,525.6	13,938.5	1,799.9	15,816.4
3	211.0	1,046.1	81.3	1,566.9	6,194.9	800.0	7,029.5
4	118.7	588.5	45.7	881.4	3,484.6	450.0	3,954.1
5	76.0	376.6	29.3	564.1	2,230.2	288.0	2,530.6
10	19.0	94.2	7.3	141.0	557.5	72.0	632.7
15	8.4	41.8	3.3	62.7	247.8	32.0	281.2
20	4.7	23.5	1.8	35.3	139.4	18.0	158.2
25	3.0	15.1	1.2	22.6	89.2	11.5	101.2
50	0.8	3.8	0.3	5.6	22.3	2.9	25.3
100	0.2	0.9	0.1	1.4	5.6	0.7	6.3

[1]At the 68-percent probability level.

[2]International 1/4-inch rule.

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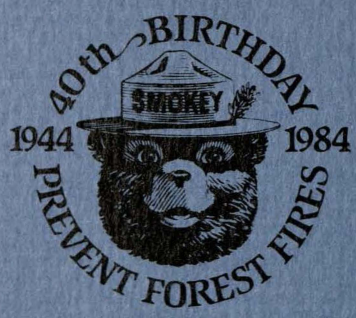
Spencer, John S., Jr.; Hahn, Jerold T.
Michigan's fourth forest inventory: timber volumes and projections of timber supply. Resour. Bull. NC-72. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station; 1984. 95 p.

The fourth inventory of the timber resource of Michigan shows growing-stock volume increased 27 percent between 1966 and 1980, from 15.1 to 19.1 billion cubic feet. Presented are highlights and statistics on volume, growth, mortality, removals, biomass, and projections.

KEY WORDS: Timber resource, statistics, growth, mortality, removals


40th BIRTHDAY
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